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US Army Corps of Engineers

The Hydrologic Engineering Center

DTIC

GENERALIZED COMPUTER PROGRAM

RESOURCE INFORMATION AND ANALYSIS

USING GRID CELL DATA BANKS

USERS MANUAL

November 1981

10 December 1984

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RESOURCE INFORMATION AND ANALYSIS USING GRID CELL DATA BANKS

COMPUTER PROGRAM 401-X6-L7590

USER'S MANUAL

NOVEMBER 1981

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RESOURCE INFORMATION AND ANALYSIS

THE HYDROLOGIC ENGINEERING CENTER

COMPUTER PROGRAM 401-X6-L7590

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RESOURCE INFORMATION AND ANALYSIS PROGRAM

USERS MANUAL

I. INTRODUCTION

1. ORIGIN OF PROGRAM

The Resource Information and Analysis (RIA) Program was developed in the Hydrologic Engineering Center, Corps of Engineers, by R. Pat Webb and Darryl W. Davis. The concepts of the RIA Program were adapted from a series of short computer programs developed by the Harvard University Laboratory for Computer Graphics and Spatial Analysis (1).* These concepts have been extensively modified, added to, revised and restructured into the executive RIA program to minimize the user's involvement in managing intermediate computer files. The initial development and documentation of the RIA program was sponsored by the Institute for Water Resources, Ft. Belvoir, Virginia. Completion of the program and documentation was sponsored by the Flood Plain Management Services Program, OCE. Mike Burnham performed major writing tasks in the development of the user manual.

2. PROGRAM PURPOSE AND CAPABILITIES

The RIA Program is designed to perform selected geographic type environmental analysis by use of a BASE DATA FILE that is a grid cell data bank. The BASE DATA FILE (that contains the grid cell representation of all resource, land use, and other grid data needed to perform the desired analysis) must have been previously created and available for access by the RIA program. RIA can perform four major types of analyses and generate computer printer graphic displays or tabulations of the analysis results.

The five major options (referred to as packages) of the RIA program are:

- o Distance Determination Package
- o Impact Assessment Package
- o Locational Attractiveness Package
- o Coincident Tabulation Package
- o Mapping Package

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* References are tabulated in the REFERENCES section.

The Distance Determination Package calculates the linear distance of each grid cell from the nearest cell containing a data variable category of interest, such as the distance of each grid cell from the adjacent cells that are categorized as industrial land use. The calculations may be performed for a specific category of a single data variable, a combination of two or more categories of a single data variable, or the combination of one or more categories of two or more data variables.

The Impact Assessment Package is designed to determine locations of high environmental impact potential resulting from an activity of interest. The analysis is based on the combination of the effects of specific groupings of categories of two or three data variables which will be impacted upon or will reflect impact potential. The analysis is designed to answer such questions as: In what areas is the potential for ground water pollution highest? What areas would be most impacted by visual blight from major construction? etc. The impact potential to be analyzed is completely flexible and definable by the user.

Locational Attractiveness modeling is an environmental land use analysis technique that emphasizes identifying the combination of locational characteristics that would be attractive for a particular activity. The technique is a computerized extension of McHarg's (2) original resource map overlay system. The computational procedure developes numerical attractiveness index values for each grid cell for the desired activity, based on subjective judgements as to attractive locational characteristics for a particular use of interest. The results are printer graphic displayed by the Mapping Package.

The Coincident Tabulation Package accounts for coincidence of categories between two data variables within the categories of a third data variable. The third variable is usually one which denotes a geographic boundary for the tabulation such as political subdivisions (town, county, etc.), census tracts, watershed subbasins, etc. An example of the coincident analysis would be the coincident tabulation of land use categories between existing and an alternative land use pattern for a particular census tract. The tabulation would display the quantitative changes in land use between the two patterns.

The Mapping Package provides computer line printer graphic displays of the variables from the BASE DATA FILE, Distance Determination, Impact Assessment and Locational Attractiveness Modeling results. The Mapping Package includes several user options such as text description of the results, levels of displays and selection of display symbolism. The graphics are produced by controlled overprinting of line printer characters.

There are no limitations on the types of analysis that may be performed within a single computer run. For example, two distance determinations, an impact assessment and five attractiveness analyses may be performed within a single run. The sequence of evaluations are made with all distance determinations being processed initially and the impact assessments preceeding the attractiveness analyses. The results of prior-in-sequence analysis

along with data stored in the BASE DATA FILE may be used in any subsequent analysis performed in the computer run, provided the intermediate results are properly saved by creating a WORKING DATA FILE.

The RIA program requires access to a BASE DATA FILE (data bank) stored on magnetic tape, disc or punched cards. The BASE DATA FILE must have been previously created by any of several data encoding and digitizing methods and the data sets stored in a fixed, prescribed sequence (see 5. DATA FILE STRUCTURE) and it must be available for access by RIA.

The current limits for various parameters in the program constrain the capabilities to the following values:

Function	Limit
BASE (OR WORKING) DATA FILE	
File Structure	First variable must be row I.D., second variable column I.D.
Number of Columns	1,000
Number of Rows	NO LIMIT
Number of Variables	50
Mapping	20 levels plus low and high
Attractiveness*	8 or less variables
Distance Determination*	5 or less variables
Impact*	3 or 2 variables
Coincident Tabulation	
Maximum grouping	30
Maximum column categories	30
Maximum row categories	25

3. HARDWARE AND SOFTWARE REQUIREMENTS

The RIA program has been developed and tested on the Control Data Corporation 7600 computer system located at the Lawrence Berkeley Laboratory. Table 1 summarizes the hardware requirements and tested running times for the program.

* Each data variable must have a code designating categories from 0 to 23, (e.g. ordinal legend rather than cardinal values).

TABLE 1

HARDWARE REQUIREMENTS AND RUNNING TIME

		CDC 7600
Compiler		Fortran
Disk or Tape devices		5
Memory (words)		144,000
Printer (positions)		132
Compilation (CPU seconds)		1.23
Execution of:	Test 1*	6.0
(CPU Seconds)	Test 2	18.5
	Test 3	15.0
	Test 4	2.8
	Test 5	18.2
	Test 6	42.4
	Test 7	2.7

* Tests are described in EXHIBIT I TEST/EXAMPLE PROGRAM

Five tape and/or disk/drum storage devices are required for scratch computations and handling of the BASE and WORKING DATA FILE. The FORTRAN logical designator for each unit and its corresponding usage are as follows:

Logical Unit	Usage
1	BASE DATA FILE (if not on cards)
2 and 3	WORKING DATA FILES
5	Card reader (input)
6	Line printer (output)
20	Scratch file for analysis packages and if the WORKING DATA FILE is saved, it is copied to this file
24	Scratch file for the Mapping Package

II. DESCRIPTION OF PROGRAM

4. PROGRAM ORGANIZATION

The RIA program consists of an executive routine that manages data transfers and controls the sequences of execution, the four basic analysis packages, and a mapping package that can display output from three of the analysis packages or the variables directly from the data bank. Figure 1 illustrates these basic functions within RIA. The interactions of the analysis and mapping packages with the DATA FILES has been simplified for clarity.

5. DATA FILE STRUCTURE

a. Overview

The tasks performed by the RIA program require access to a specifically constructed grid cell data bank.* The contents of the data bank* (specific variables and classes within variables) must be chosen so that the desired analysis may be performed. There is no "set" group of variables that must or should be catalogued into the data bank.

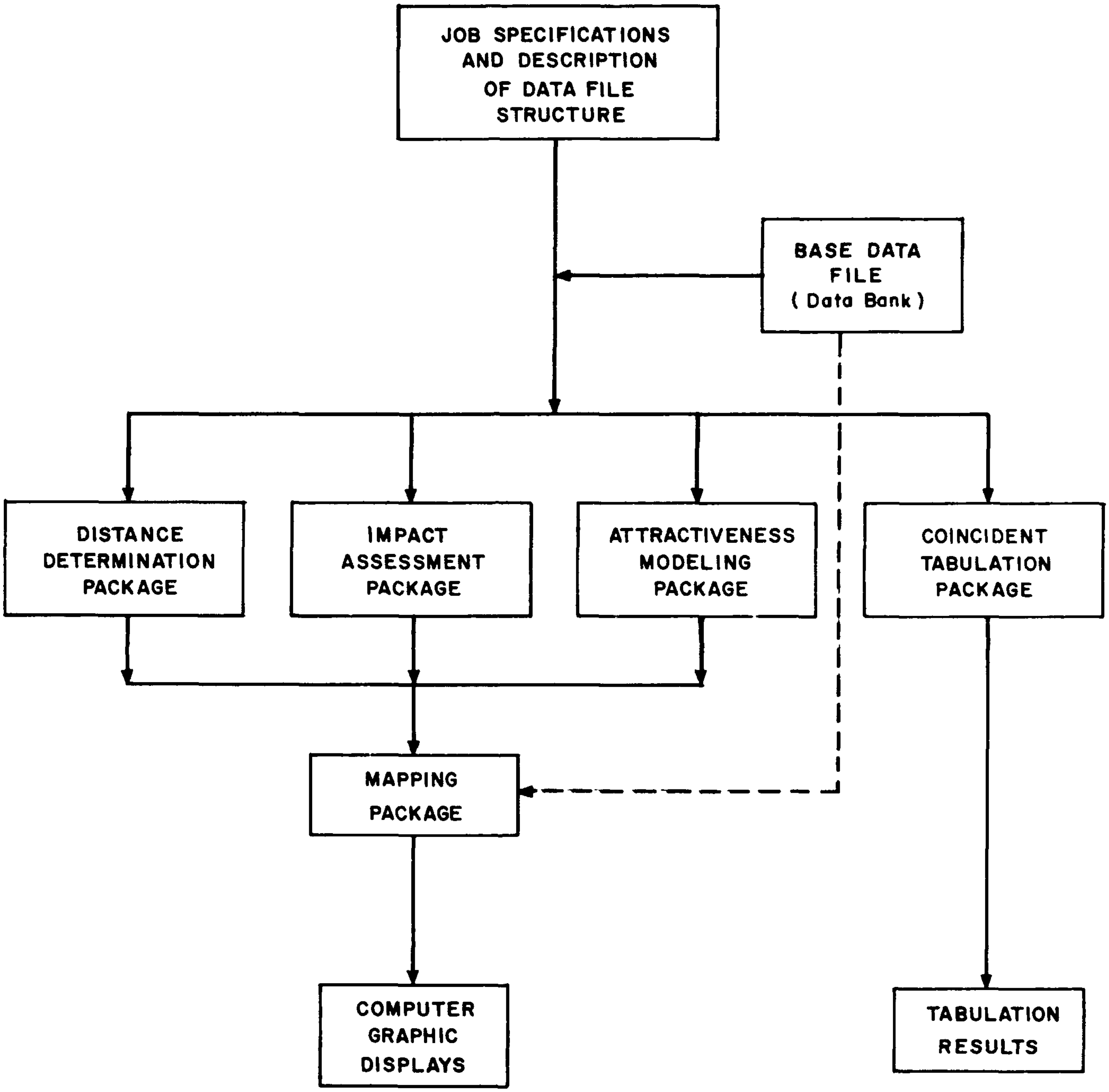
The development of the grid cell data file* requires that each data variable map be individually encoded and geographically registered to a common base and stored, along with other data variables in the data bank, on a computer storage device. Conceptually, the grid encoded data variables may be viewed as grid cell maps on which each cell is legended with the proper feature for each of the data variables. The data file is created as a series of sequential grid cell records each of which contains the data variables. The data file* thus constructed becomes the BASE DATA FILE that is available for analysis. The data variables needed for a specific analysis are retrieved from the BASE DATA FILE and processed by RIA.

The results from the Distance Determination, Impact Assessments and Attractiveness Modeling may be displayed in computer graphic or number matrix form. If desired the new results may become new data variables. A new data variable may be displayed as the final results, used in interim processing for additional analysis in a single computer run or as a permanent data variable for use in subsequent analyses.

A WORKING DATA FILE is constructed which includes the data variable sets in the BASE DATA FILE and the newly developed data variables. If the new data variables are to become a permanent part of the data bank, the WORKING DATA FILE becomes the BASE DATA FILE for future evaluations.

---

* Note that "data bank,""data file," and "grid cell data file" are used interchangeably throughout this manual and have identical meaning.



FUNCTIONAL SCHEMATIC RIA PROGRAM COMPONENTS

Figure 1

b. BASE DATA FILE Structure

The grid cell data stored in the BASE DATA FILE are in the form of a multivariable grid cell record. The structure of the BASE DATA FILE becomes a sequential grid cell inventory of all the data variable value assignments that correspond to each individual cell. Figure 2 illustrates the basic concepts and structure of the sequential grid cell record of the BASE DATA FILE. The data variables are depicted as hypothetical planes that are overlayed so that each grid cell location is in alignment with its location on each of the other data sets. The grid cells that comprise the study area in Figure 2 consist of k rows and j columns, and are numbered sequentially from 1 thru k, and 1 thru j, respectively.

The RIA program accesses data from the BASE DATA FILE based on an assumed specific structure of the file. The program expects each multivariable record to be stored in the data bank sequentially, row by row, as illustrated. The entry of the first data variable would require the grid cell value assignments of the first grid cell row to be sequentially recorded from 1 to j, with j being equal to the total number of columns per row. This process is continued until the final row (k) of the data variable is recorded. This process is repeated for each of the data variables to be included in the BASE DATA FILE. The BASE DATA FILE may be either formatted or unformatted.

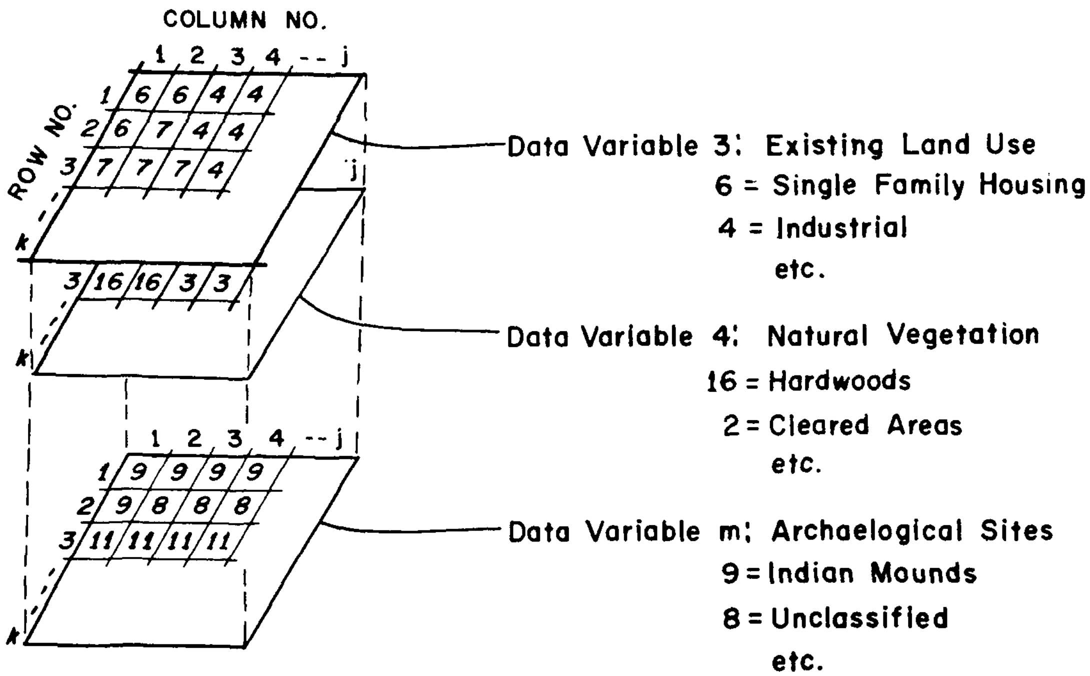
For data banks encompassing large geographic areas and comprising a large number of grid cells, it may be desirable to create and make use of a "packed" grid cell data bank, a method of storage in which only the grid cells inside the study area are stored. If a "packed" file is used, there must be an additional grid cell record which has a row value of at least one greater than the largest row number in the data file. With either file structure, the first data variable must be the row identifier and the second variable must be the column identifier of the grid cell.

c. WORKING DATA FILE

The use of a WORKING DATA FILE is required where the results of one or more analyses are used in subsequent analyses within a single computer run. The WORKING DATA FILE consists of the data variables of the BASE DATA FILE and those generated in some part of the analysis process. If the generated results stored in the WORKING DATA FILE are to be permanently saved for future evaluations, the WORKING DATA FILE becomes the new BASE DATA FILE and must be stored on a permanent computer storage device. The WORKING DATA FILE is always unformatted.

The use of the WORKING DATA FILE is illustrated in Figure 3. In the first example (Figure 3.a) the RIA results are based on the data variables retrieved from the BASE DATA FILE and not on any interim analysis results of the computer run. In Figure 3.b the evaluation requires the creation and use of the WORKING DATA FILE since subsequent analyses are based on existing and newly generated data variables.

CONCEPTUAL OVERLAY OF BASE DATA FILE STRUCTURE



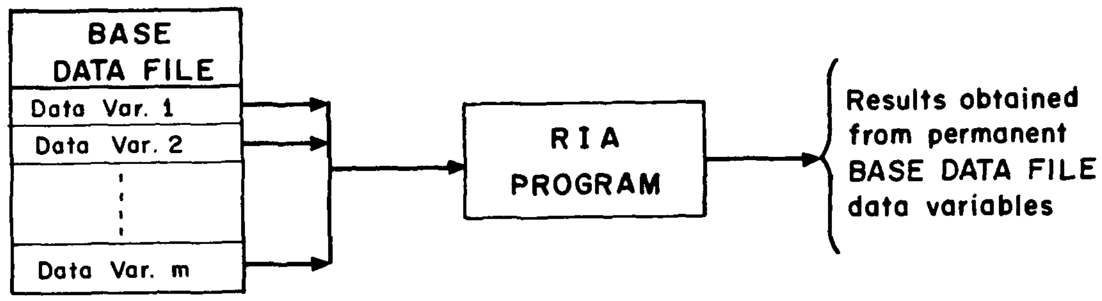
BASE DATA FILE STRUCTURE
(GRID CELL VALUE ASSIGNMENTS)

	Grid Cell Record	Data Var. 3	Data Var. 4	• • • • • •	Data Var. m
ROW 1	1	6	12		9
	2	6	12		9
	3	4	12		9
	4	4	11		9
	•	•	•		•
	•	•	•		•
	j	•	•		•
ROW 2	•	6	21		9
	2	7	22		8
	3	4	22		8
	•	•	•		•
	•	•	•		•
	j	•	•		•
	•	•	•		•
	•	•	•		•
	•	•	•		•
	(j,k)	•	•		•

CONCEPTS AND STRUCTURE OF THE BASE DATA FILE

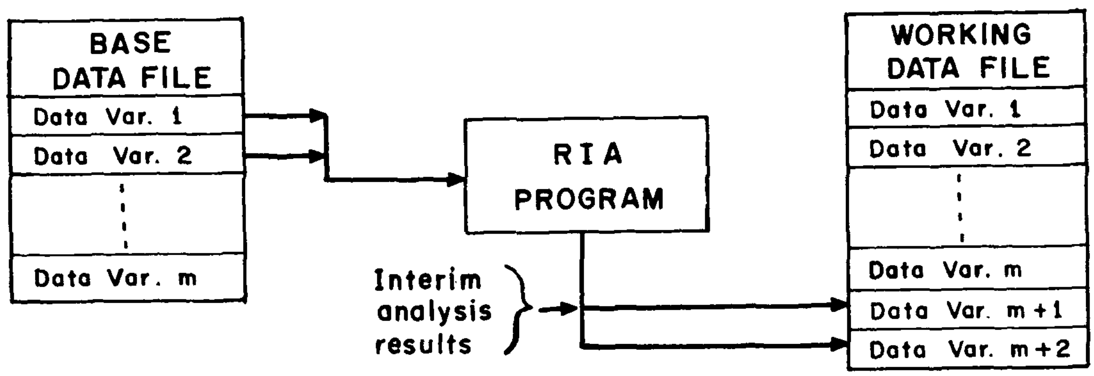
Figure 2

a. WORKING DATA FILE Not created

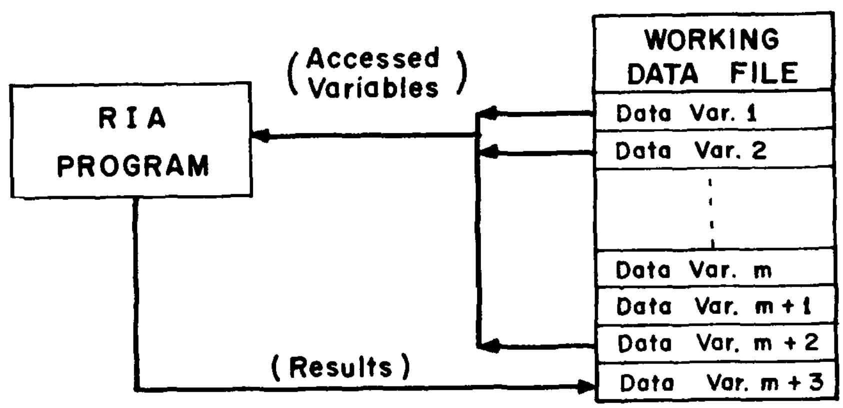


b. Use of WORKING DATA FILE During Execution of RIA program
(single computer run)

(1)



(2)



WORKING DATA FILE PROCESS

Figure 3

The user must make note of the sequence in which RIA performs the analyses (all Distance Determinations, all Impact Assessments, and all Attractiveness Modeling) so that temporarily created (or permanently created, for that matter) variables can be correctly retrieved for use.

6. DISTANCE DETERMINATION PACKAGE

a. Overview

The Distance Determination Package performs a systematic search and computation of the distance of each grid cell from the nearest cell assigned a category of interest. The distance calculations can be performed for:

- o A specific category of a single data variable
- o A combination of two or more categories of a single data variable
- o A combination of one or more categories of two or more data variables

The result from the search are grid values comprising a new data variable with the calculated distance assigned to each grid cell. This data variable may be used as an interim variable for additional evaluations and/or stored as a permanent variable in the BASE DATA FILE. The Distance Determination Package is often used as an interim processing method of generating data variables for the Impact Assessments and Locational Attractiveness Modeling Packages. This package is usually relatively more expensive to run than the other analyses so searches should be carefully formulated and the results stored as a permanent variable in the BASE DATA FILE.

b. Computational Procedures

The distance determination for each grid cell in the data bank is performed by a systematic search of the BASE DATA FILE to locate the grid cells which contain the data categories of interest. These cells are assigned a distance value of zero. The non-zero cells are then processed individually by calculating the distance from the nearest zero valued cell by computing the linear distance between the centroids of the two cells. Equation 1 is used to perform these calculations.

$$D=\sqrt{(A_1\ (X_1 - X_0))^2 + (A_2\ (Y_1 - Y_0))^2} \qquad (1)$$

$$A_1 = X/DINV, \qquad A_2 = Y/DINV \qquad (2)$$

where D = the linear distance (in DINV units) between the centroid of the two grid cells

X = the X (horizontal) dimension of a grid cell

X_1 = the X (column) coordinate of the grid cell being processed

X_0 = the X (column) coordinate of the nearest zero valued grid cell

Y = the Y (vertical) dimension of a grid cell

Y_1 = the Y (row) coordinate of the grid cell being processed

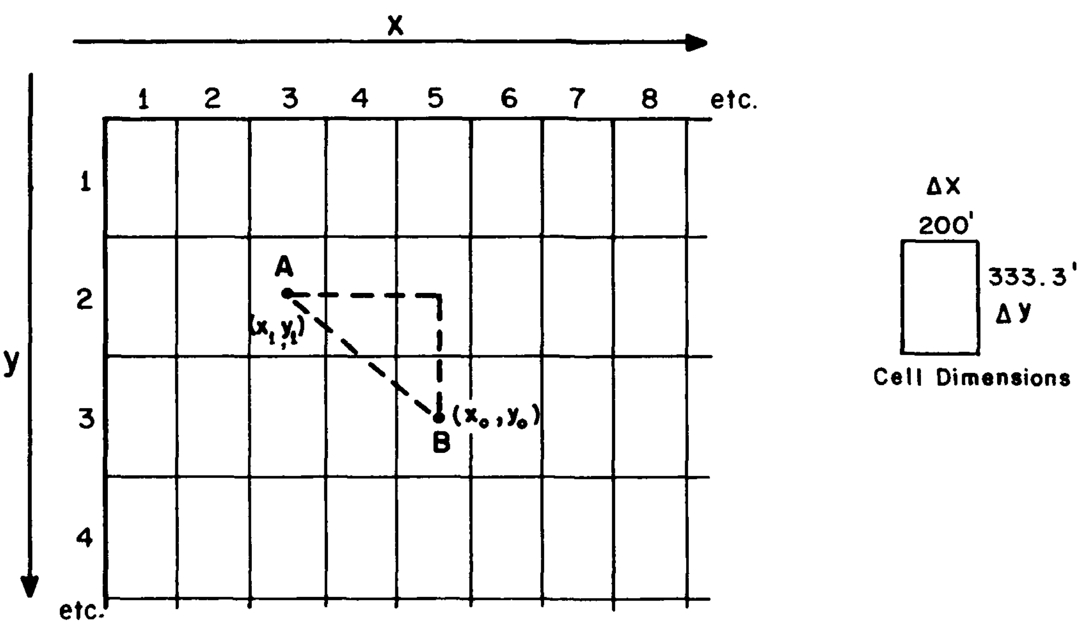
Y_0 = the Y (row) coordinate of the nearest zero valued grid cell

DINV = the radius interval for classifying distance

The radius interval allows grouping of cells by distance bands, for example if one were interested in changes no more frequent than ¼ mile, DINV could be specified as 1320.

An example of the computational procedure is shown following.

Example Distance Determination: Using the following illustration, calculate the linear distance between grid cells A and B. The grid dimensions correspond to the space on a U.S.G.S. quad sheet that would be occupied by a standard line printer computer character printed at a vertical spacing of 6 lines per inch.



Assume: Grid Cell A = cell which distance computations are to be made.

Grid Cell B = zero valued cell

The distance in DINV units is computed directly from equations (1) and (2). For a 200 ft. radius search (DINV = 200), D is computed as

$$A_1 = \frac{200}{200} = 1.0 , \qquad (3) \qquad\qquad A_2 = \frac{333.3}{200} = 1.67 \qquad (4)$$

$$D = \sqrt{(1.0\ (3 - 5)\ )^2 + (1.67\ (2 - 3)\ )^2} = 2.6 \qquad (5)$$

The calculated distance value or interval is stored as a decimal value but for map output or Attractiveness analysis is truncated to an integer value. This is done so that the distance information may be used as discrete, class information in the same manner as the category classification of other geographical information. The maximum distance interval assigned is 23, with grid cells having a greater distance interval being assigned the maximum value. The limit of 23 for the maximum distance determination interval is maintained so that primary use of the results are compatible with Attractiveness and Impact analysis which are limited to 24 discrete class intervals (0 to 23) for each data variable used in the analysis.

7. IMPACT ASSESSMENT PACKAGE

a. Overview

The impact assessments performed by the RIA program are designed to highlight areas of high environmental impact potential resulting from an activity of interest, such as, determining areas most susceptible to negative wildlife habitat impacts resulting from urban development. The computed potential impact is not an absolute quantitative representation of the actual impact but a relative representation reflecting potential impacts based on the interaction between data variable categories or classes. The computations are based on the combination of categories of two or three data variables, relative to the activity, which either are impacted upon or reflect impact potential. The assessment procedure used is the development of a two data variable matrix with the interaction between the categories of each data variable described in relative terms. If a three variable assessment is performed, the results of the initial matrix are used to develop a final matrix with the third (most significant) data variable. The output is a display of the potential impact for the activity (one of the variables) of interest.

b. Assessment Procedures

The impact assessment procedures include the ranking of the selected data variables in order of importance and reclassifying their categories into one of five potential impact classes: 1) EXTREME, 2) SEVERE, 3) MODERATE, 4) SLIGHT and 5) NULL. After the data variables are ranked and the categories are reclassified, initial and final impact combination matrices are developed. If the assessment is performed for only two data variables, the initial impact matrix is not constructed.

The initial impact matrix is developed to calculate the impact potential based on the specific combination of impact categories of the second and third most important data variables used in the assessment. The rows of the matrix are the impact potentials of the least important data variable in the analysis, with the columns representing the impact potentials of the second most important data variable in the analysis. The matrix is completed by assigning one of the five impact potentials (extreme through null) to each of the boxes of the matrix. Figure 4 illustrates the initial matrix prior to assignment of the impact interactions. The matrix may be completed by a user selected interaction assignment or by using one of the four standard (default) interaction matrices available in the RIA program. Figure 5 shows the four standard interaction matrices available as options.

COLUMNS
(Second Most Important Variable)

ROWS
(Least Important Variable)

	EXTREME	SEVERE	MODERATE	SLIGHT	NULL
EXTREME					
SEVERE					
MODERATE					
SLIGHT					
NULL					

INITIAL IMPACT POTENTIAL MATRIX

Figure 4

STANDARD 1 - EQUAL WEIGHTING

Most Important Variable

Next Most Important (or Least)	EXTREME	SEVERE	MODERATE	SLIGHT	NULL
EXTREME	Extreme	Extreme	Severe	Severe	Moderate
SEVERE	Extreme	Severe	Severe	Moderate	Moderate
MODERATE	Severe	Severe	Moderate	Moderate	Slight
SLIGHT	Severe	Moderate	Moderate	Slight	Slight
NULL	Moderate	Moderate	Slight	Slight	Null

The rows and columns are equal with the mean impact being assigned to the cells.

Figure 5. STANDARD MATRIX OPTIONS

STANDARD 2

Most Important Variable

Next Most Important (or Least)	EXTREME	SEVERE	MODERATE	SLIGHT	NULL
EXTREME	Extreme	Severe	Severe	Moderate	Slight
SEVERE	Extreme	Severe	Moderate	Moderate	Slight
MODERATE	Severe	Severe	Moderate	Slight	Slight
SLIGHT	Severe	Moderate	Moderate	Slight	Null
NULL	Severe	Moderate	Slight	Slight	Null

The columns are twice as important as the rows. The effects are additive.

Figure 5. STANDARD MATRIX OPTIONS (Continued)

STANDARD 3

Most Important Variable

Next Most Important (or Least)	EXTREME	SEVERE	MODERATE	SLIGHT	NULL
EXTREME	Extreme	Extreme	Severe	Moderate	Slight
SEVERE	Extreme	Severe	Moderate	Slight	Slight
MODERATE	Extreme	Severe	Moderate	Slight	Null
SLIGHT	Severe	Severe	Moderate	Slight	Null
NULL	Severe	Moderate	Slight	Null	Null

Column categories dominate row categories - Version 1

Figure 5. STANDARD MATRIX OPTIONS (Continued)

STANDARD 4

Most Important Variable

Next Most Important (or Least)	EXTREME	SEVERE	MODERATE	SLIGHT	NULL
EXTREME	Extreme	Extreme	Severe	Moderate	Moderate
SEVERE	Extreme	Extreme	Severe	Moderate	Slight
MODERATE	Severe	Severe	Moderate	Slight	Slight
SLIGHT	Moderate	Moderate	Moderate	Slight	Null
NULL	Moderate	Slight	Slight	Null	Null

Extreme and Severe categories are the most important with effects reduced from Moderate to Null.

Figure 5. STANDARD MATRIX OPTIONS (Continued)

After the final impact potential matrix has been constructed, the BASE DATA FILE is accessed and each grid cell is assigned an impact potential based on the specific combination of reassigned category impact classes of the selected data variables located in the grid cell and the corresponding value in the final impact potential matrix. A numeric value of 0 (zero) is assigned to cells which have a null impact, 3 to cells with a slight impact, 5 to cells with a moderate impact, 7 to cells with a severe impact and 10 to cells with an extreme impact.

The final matrix is developed between the potential impact results of the initial matrix and the potential impact of the most important data variable. The final matrix is identical to the initial matrix in structure with the most important variable representing the column classes and the results of the initial matrix or second most important data variable the row classes. The impact potentials of the final matrix are either user assigned or one of the standard options.

8. LOCATIONAL ATTRACTIVENESS MODELING

a. General Concepts

Locational Attractiveness Modeling develops an index value for each grid cell based on specific combinations of data variables in the BASE DATA FILE. The index value computed represents the relative attractiveness of each grid cell for a desired activity based on the specific combination of pertinent geographic information at each grid cell location. The attractiveness analysis is an extension of McHarg's (2) manual technique of selective graphic overlaying of geographic data to determine a location for an activity of interest. McHarg's method is based on shading or coloring map features to reflect the suitability of areas as a series of color shades, with the more desirable the area the darker the shade. The mylar maps are then placed on top of one another and legended with respect to each other with the composite darker shades representing the most desirable locations for the activity of interest. If a particular map is twice as important as the other maps, it is duplicated and included twice in the composite overlays.

b. Analysis Procedures

Each data variable category used in attractiveness analysis is reclassified based on a relative scale of zero to ten, with ten being the most attractive. If one or more categories are desired to be excluded from consideration in the analysis, the attractiveness index is assigned a value of -1 (minus one). The number of times each data variable is included (overlayed) in the analysis is the relative importance component in the analysis. The raw attractiveness index values are computed from:

$$\text{INDEX}_{ij} = \Sigma \ (A_k B_l) \qquad (6)$$

where INDEX = the raw attractiveness index value of the grid cell in ith row and the jth column

and A_k = the relative importance of the kth data variable in the analysis

B_l = the attractiveness of the lth data class or category of the kth data variable

The computed raw index values from any given analysis are relative only to the index values generated in the analysis. This is because there is no real value associated with an absolute unit of computed raw index value, so the computed raw index values from different analyses may not be directly compared with one another.

The index values may be standardized (normalized to a common range) by two alternative methods. One method standardizes based on an assumed normal (gaussian) distribution of raw index values, and the other based on an assumed uniform distribution of raw index values.

The first method (Standardized I) determines the deviation of the computed raw index value of each grid cell in relation to the mean (average) computed raw index value. These deviations are then interpreted as emanating from a gaussian population of computed index values that has a true mean of 50 and a standard deviation of 25. The standardized value for each cell is then computed as follows:

$$\text{Standardized I} = \left(\frac{(\text{Cell index - mean index})}{\text{Standard Deviation}} {*}25 \right) + 50 \qquad (7)$$

This method may generate a few values that lie outside the range 0 to 100, because theoretically 95 percent of the standardized values should fall within the range of 0 (zero) to 100 (one hundred).

The second method of standardization (Standardized II) normalizes the range of values by placing each raw index value at its appropriate linear location on a standard scale of 0 to 100. The standardized value for each cell is computed as follows:

$$\text{Standardized II} = \frac{(\text{Cell index - Min. index})}{(\text{Max. index - Min. index})} \left(100.0 \right) \qquad (8)$$

Grid cells which have been rejected (recoded -1 for a data category) are also assigned a standardized index value which is a flag to note that it has been rejected. The rejected cells from the Standardized I method are assigned a value of -100 (minus one hundred) and the rejected cells from the Standardized II method are assigned a value of -1 (minus one).

If the Standardized I values are used and cells are rejected, care must be taken in specifying the options for the Mapping Package. If the standard default range option (see Mapping Package) for the graphics is used (ten equal levels), the valid standardized index values may be grouped into only a few of the display levels because the data range is -100 to +100 and all of the values will fall into the upper 5 levels. To compensate for this, the display levels should be redefined by appropriate input specifications.

9. COINCIDENT TABULATION

The Coincident Tabulation develops an accounting for the coincidence of classes or categories between two data variables within the classes or categories of a third data variable. For example, suppose there was an interest in determining the number of acres of wildlife habitat among various vegetation zones and grouped by watershed units. The analysis would examine each grid cell to determine the boolean combination between habitat and vegetative class and summarize and print the results by watershed unit. Another possibility might be to determine the shifts of categories over time by using two variables that represent say land use or vegetative cover, at two points in time and tabulate within a geographic grouping, such as county or city. Test problem 7 compares shifts in land use between two time periods.

10. MAPPING PACKAGE

a. Introduction

The Mapping Package produces line printer graphic output of analysis results from the BASE (or WORKING) DATA FILE, Distance Determination, Impact Assessments and/or Attractiveness Modeling. The Mapping Package was created from the computer program GRID, developed by the Laboratory for Computer Graphics and Spatial Analysis, Harvard University. The standard GRID program was modified and interfaced with the analysis packages. A significant portion of the options available for executing GRID were "fixed" so that users of RIA need only be concerned with input items that are necessary for these analyses. A complete description of the GRID program is contained in (3).

b. Printer Graphics

The Mapping Package produces single character or "grey shade" printer graphics by overprinting one or more selected printer characters for each grid cell data point. Overprinting is the printing of a string of characters in the same output location. The grey shades are achieved by

using selected printer characters designed to produce the desired effect. For example, light shades can be produced by single characters such as zeros and dark shades by overprinting an Ø with a +, X and Z. The specific overprinting character selection can be designed by the user (any printer character may be used) if a unique output display is desired, or the standard overprint characters (default characters) shown below may be used.

Standard Overprint Symbolism in M4 Card Format

	Card Column																					
Card	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	23
M4	M	4																				
M4-2	·	·	+	/	X	Ø	Ø	Ø	Ø	Ø	1	2	3	4	5	6	7	8	9	*	L	H
M4-3		,					/	-	+	X												
M4-4									/	A												
M4-5										Z												

c. Levels and Ranges

The default print option uniformly divides the grid file output into 10 levels of equal range. For example if a grid file contained elevations ranging from 150 to 550 feet, level "one" would be printed as the indicated printer character (column 1 above on M4-2) for all grid cells with elevations from 150 to 190, level 2 (column 2) with the indicated printer characters for all cells from 190 to 230, etc., to level 10 ranging from 510 to 550.

The number of levels may be specified by the user (a maximum of 22 is permissible, considering the low (L) and high (H) designations), the range associated with each specified level may be specified (in the above example the range was 40 feet for all levels), and the overprint symbolism m may be custom designed by the user. For example, one might be interested primarily in elevations above 480 feet and wish to distinguish variations of 10 feet elevation change. The map specifications input would thus specify 8 levels as follows.

Level	Range
1	330 (150 to 480)
2	10' (480+ to 490)
3-8	10' (490 to 500, 500 to 510, etc.)

Tests 1-4 and 6-7 of EXHIBIT I TEST/EXAMPLE PROBLEMS make use of the standard 10 levels of uniform range and standard overprint symbolism and Test 5 illustrates output for which the levels, ranges and overprint symbolism were custom designed for that particular analysis.

III. INPUT PREPARATION

11. GENERAL DESCRIPTION

This section describes the type and characteristics of data which are entered on each card and which cards should be used for performing a variety of analysis. Specific input instructions and format are contained in EXHIBIT II INPUT DESCRIPTION.

The program has been designed to be flexible in the type or sequence of analysis permitted and to reduce the system oriented data manipulations typical of data bank oriented analysis. Care must be taken, because of this, to be consistent in referencing data variables in the files and noting and cataloguing the sequence in which new variables (perhaps created by the analysis) are added. A number of the cards are optional and need not be provided unless those particular data are needed, a particular type of analysis is desired, or selected portions of the output are desired to be other than that provided by default.

12. PROGRAM DATA CARD HIERARCHY

Table 2 displays the heirarchy of major data types.

13. DATA CARD DESCRIPTIONS

a. T1 - T3 Title Cards

The three title cards are available for use to identify the unique features of a particular job so as to provide an unambiguous record of analysis performed. Useful items to note on the title cards include project name, run date, data base used, unique identifier, such as land use policy change, and a systematic, sequential numbering system to permit easy file storage and retrieval.

b. Job Cards

These cards input data to control the flow of the job, manage the file system, and provide basic data base specifications.

J1: First Job Card: This required card describes the number and types of analyses to be performed. Input is provided to define the number of Distance Determinations, Impact Assessments, Locational Attractiveness analyses, and the number of maps to be produced from the BASE DATA FILE. The program will expect to find appropriate input cards to define each of the analysis types specified.

TABLE 2

PROGRAM DATA CARD HIERARCHY

<u>Job Cards</u>	
o JOB TITLE o ANALYSIS TYPES o BASE DATA FILE SPECIFICATIONS o BASE DATA FILE FORMAT (optional)	The data apply to the entire job.
<u>Distance Determination Cards</u>	
- SEARCH SPECIFICATIONS - SEARCH TITLE	Apply to each search
* VARIABLE RECODING	Applies to <u>each</u> variable search
<u>Impact Assessment Cards</u>	
- IMPACT ASSESSMENT TITLE - IMPACT ASSESSMENT SPECIFICATIONS	Apply to each impact assessment
* VARIABLE RECODING	Applies to <u>each</u> variable used
- IMPACT INTERACTION MATRIX	Applies to each impact assessment
<u>Attractiveness Analysis Cards</u>	
- ATTRACTIVENESS MODELING SPECIFICATIONS - ATTRACTIVENESS TITLE	Apply to each attractiveness analysis
* VARIABLE RECODING	Applies for <u>each</u> variable used
<u>Coincident Tabulation Cards</u>	
- COINCIDENT ANALYSIS TITLE - COINCIDENT SPECIFICATIONS	Apply to each analysis
- ROW & COLUMN TITLES	Applies for each variable
<u>Mapping Cards</u>	
- MAP TITLE - LEVEL SPECIFICATION - RANGE SPECIFICATION - SYMBOL SPECIFICATION - EXECUTION COMMAND	Apply to each map

J2: Second Job Card: This required card describes the contents and structure of the BASE DATA FILE. The location of the file (tape or disc, cards), the format structure, number of data variables, and number of rows and columns comprising the file are specified. The flag to create and save a WORKING DATA FILE for subsequent use is located on this card.

J3: Third Job Card: This optional job card specifies the precise format (in acceptable FORTRAN form) of the stored record of the BASE DATA FILE.

c. D Cards - Distance Determination

The D Cards specify the operations required to cause Distance Determinations to be performed. All distance determinations (as specified on the first Job card), are performed before proceding to the next type of analysis. The results from each distance analysis are placed in the WORKING DATA FILE if requested and are available for subsequent analysis. For graphic display of results, map cards must follow each D card set.

D1 Card: This required distance determination card specifies the number of variables to be used, a flag for graphics, grid cell dimensions (x and y), a distance interval for ordinal scale grouping radius, and an output label.

D2 Card: This required card contains data that causes retrieval of the appropriate variables and identifies the characteristics to be searched. A D2 card is required for each variable that is used for a specific distance determination. The recoding to flag characteristics for which distance determination will be made are accomplished in 2 column subfields of the standard data field structure.

d. I Cards - Impact Assessment

The I cards specify the operations required to cause Impact Assessment to be performed. All impact assessments (as specified on the first Job Card) are performed after all distance determinations and associated mapping are completed and prior to other operations. The output is generally in map form requiring that map cards follow. The results may be stored in the WORKING DATA FILE for use in subsequent analysis.

IT Cards: Three cards are required for output labeling which will appear on the first page of output from each impact assessment. The opportunity to label output should be used for information and bookkeeping purposes, and to define unique aspects of the particular assessment performed.

I1 Card: The I1 card specifies the number of variables to be used and flags which of the optional impact matrices to be used. The analysis may be performed for two or three variables, the latter requiring the construction of an intermediate matrix that may be specified.

I2 Card: Two or three cards are required, one for each variable to be used, as specified in the I1 card. The relative importance of each variable is specified (importance can be interpreted similarly to the 'independent' variable) and the characteristics recoded representing the impact relationship for each category of the variable being coded. Provision for a variable title output label is also available.

IM Card: Five IM cards are required for the initial impact matrix when three variables are specified. Each IM card specifies one row in the impact matrix. The matrix is constructed to define the relationship between the second and third most important variables.

FM Cards: Five FM cards are required to define the impact relationship between the second and first most important variables. Each card represents one row in the impact matrix.

e. A Cards - Attractiveness Modeling

These cards specify the operations required to cause locational attractiveness to be performed. All locational attractiveness modeling is performed after the impact assessments have been completed. Output is usually in map form requiring map cards to follow attractiveness modeling cards. The results may be stored in the WORKING DATA FILE for use in subsequent analysis.

A1 Card: This required card defines the number of data variables and display options selected. The display options include specification of the manner of standardizing the index values (raw, uniform range or normal density function), the levels of display (optional 20), and text output for labeling.

A2 Card: An A2 card is required for each of the data variables used in the attractiveness analysis. Each A2 card specifies the variable, and recoding to provide the weights to be used to compute the attractiveness index.

f. C Cards - Coincident Tabulation

These cards specify the operations necessary to cause the coincident tabulation to be performed. Coincident tabulations are performed following attractiveness analysis. The output from coincident tabulations is tabular and may not be stored in the WORKING DATA FILE for subsequent use. Three data variables are needed to perform the analysis, two for which coincidence between classes is to be determined in a category of the third variable.

CT Cards: Three title cards are required for job output labeling. Any alphanumeric label that can aid in identifying and cataloguing the program output may be used.

C1 Card: This required card specifies the size of each grid cell in acres to cause tabulation to be in meaningful areal units, and contains flags for optional percentage labeled output.

C2 Card: This required card defines the data variable and categories in which the coincidents will be grouped.

T2 Card: A T2 card is required to describe the group title for the categories in which the coincidents are grouped.

C3 Card: This required card defines the data variable corresponding to the row values in the coincidents matrix. The data specified is the variable, number of categories and general variable title.

T3 Card: A T3 card is required to describe the category title for each category of the data variable specified on the C3 card.

C4 Card: This required card defines the data variable corresponding to the column values in the coincidents matrix. The data specified is the variable, number of categories and general variable title.

T4 Card: A T4 card is required to describe the category title for each category of the data variable specified on the C4 card.

g. M Cards - Mapping

The mapping package is a utility routine available for displaying line printer plots of selected output. The routine is a limited version of a more general mapping package entitled GRID. Several of the mapping features are optional and may be specified on these cards. The Mapping Package may be called to map variables directly from the BASE or WORKING DATA FILE or the analysis packages. The appropriate map cards are inserted in the job data stream whenever map output is desired.

MP Card: This required card specifies the data variable to be displayed and several options. The information to be specified includes the sublevel text flag, flag to indicate the particular line printer mode of overprint control, and minimum display value.

M1 Card: This optional card may be used to specify the value range for mapping. Values outside the range specified will be lumped and printed with an L or H as appropriate.

M2 Cards: This optional card specifies the number of levels or class intervals that are desired for output display.

M3 Cards: This optional card is a companion to the M2 card and specifies the relative size of each of the levels specified on the previous M2 card.

M4 Cards: These optional cards may be used to specify the overprint characters that will be output as the grey shade symbolism for each of the levels (either the 10 default or those specified on M2 and M3 cards). The first M4 card flags that overprint optional input will be provided; the second M4 card contains the overprint character for the first overprint for each mapping level; the third M4 card contains the second overprint character for

each mapping level; the fourth M4 card contains the overprint character for each of the mapping levels and the fifth M4 card similarly for the fourth (and last) overprinting.

M5 Card: This optional card may be used to increase the size of the grid cell mapping character to assist in representing maps of different scales. The enlarged mapping character size must be expressed in multiples of the original grid cell character size.

M6 Cards: These optional cards may be used to reclassify and/or aggregate a specified data variable value to a specific map level.

MS Card: This required card flags the termination of the data input card stream for the map package.

Text Cards: Any number of additional text cards may be included.

ENDT Card: Signals the end of the optional text input.

Sublevel Text Cards: These optional cards permit the addition of up to 3 cards each of sublevel text (text to legend symbols) for map output.

99 Card: This card flags the end of sublevel text input.

ME Card: This required card causes execution of the map package to be initiated.

IV. OUTPUT DISPLAYS

14. DISPLAY SEQUENCE

The possible sequence of output from RIA will be 1) general title, job controls and data bank particulars, 2) maps of variables from BASE DATA FILE, 3) distance determinations (as many as are specified), and maps of results if specified, 4) impact assessments (as many as specified), and maps of results if specified, 5) locational attractiveness (as many as specified) and maps of results if specified, and 6) coincidents analysis.

15. INITIAL JOB DATA

The first page of all computer runs contains reformatted output of the title cards (3), card column data entry images of the job cards (J1, J2 and J3 cards), a summary of the operations to be performed, configuration and format of the data bank. The annotation of the options comes directly from the J1 and J2 card image data except for one important item. The number of data variables in the WORKING DATA FILE is automatically derived and printed as the number of variables in the BASE DATA FILE (input) and the number of Distance Determinations, Impact Assessments and Attractiveness Models specified on the J1 card.

16. MAP DISPLAY

Map output is labeled with the bold heading MAP PACKAGE, followed by card column data entry images of job input and a summary of options exercised then followed by the overprint map. The output consists of an overprint map, title and legend. The overprint map will be a single character for each grid cell, such as EXHIBIT I, Test 1, in which land use is mapped, and the mapping symbols are the numeric categories of land use, or may be standard multi-character overprint (such as Test 2, distance determination results) using the default symbolism. The map display will run continuously, no line space skips at page junctions and if requires more space than the page width, will be printed on another panel that may then be joined. The border includes sequential numbering from the upper left corner, noted at each 10 character or line spaces so that easy reference to a location on the map is possible.

The map is followed by the title, an indication of data extremes and the legend. The legend headings and their definitions are:

LEVEL NUMBER: The nomenclature used to refer to the mapping categories. LEVEL 1 is the mapping category for the lowest magnitude values.

SYMBOL:	The corresponding overprint symbolism for each mapping level.
VALUE RANGE:	The lower and upper bound of the magnitude of values that are mapped in the corresponding level.
PERCENT VALUE RANGE:	The percentage of the <u>range</u> of values that are mapped in the corresponding levels.
FREQUENCY:	Number of grid cells that fall within the corresponding value range.
PERCENTILE RANGE:	Cumulative percentage of the number of cells falling within the corresponding value range.
PERCENT OF AREAS:	The proportion of mapped cells that fall within the corresponding mapping level and value range.

The default mapping specifications result in 10 mapping levels, each with 10 percent of the value range. Most output maps shown for the tests make use of the default 10 equal value mapping levels. It is possible to make use of 22 mapping levels and uniquely designed overprint symbolism.

17. DISTANCE DETERMINATION

The additional output (over initial job data) begins with the bold heading DISTANCE DETERMINATION and includes card column data entry images and a summary of options used and search specifications. Test 2 is an example of a distance determination. The analysis specifications identify the variables being searched, and the recoding necessary to cause the desired distance determination to be performed. A note on the output explains the recoding scheme. The map display, if requested, is an overprint representation of the distance to desired features. An option permits a number map to be produced that would be the two character level of the distance. For example, a cell 1400 feet from a desired category for a distance determination specifying a grouping interval of 200 feet would be printed as 07. The values that may be printed range from 0 to 23.

18. IMPACT ASSESSMENT

The additional output (over initial job data) begins with the bold heading IMPACT ASSESSMENT and includes card column data entry images and a summary of options used and impact analysis specifications. This is followed by the initial impact matrix (if three variables), final impact matrix and map display if requested. Test 3 and Test 4 are, respectively, impact analysis of 2 and 3 variables. Test 4 indicates "Potential Groundwater Pollution" is the title, that data variables 7 (soils), 8 (slope) and 10 (land use) are used and the categories within each variable having extensive, severe, moderate, slight or null impact potential (the codes are 5 through 1 ranging from severe to null). The number of cells falling in each category is printed following the Final Matrix. An overprint display map is generated if requested.

19. LOCATIONAL ATTRACTIVENESS

The additional output (over initial job data) begins with the bold heading ATTRACTIVENESS MODEL and includes card column data entry images and a summary of options used and locational attractiveness specifications. A line printer overprint map is produced if requested and is the usual output mode for this analysis. Test 5 is a two variable attractiveness analysis. The number of cells evaluated is indicated and the number rejected (recoded with -1 to delete from analysis) is also printed. The variables recoding and relative importance between variables (INDEX WEIGHT) are printed. The recoding values are -1 (reject), 0 (no importance) and 1 through 10 (relative importance between categories, 10 being the highest). Statistics summarized are mean, maximum, minimum, and standard deviation for the computed (raw) and alternative standardization modes. Standardized I is an assumed Gaussian distribution of values and standardized II is an assumed uniform distribution. The option selected is noted by a printout note. Map output follows. Note for Test 5 that the level option of the MAP specifications was exercised so that output was restricted to 6 levels. Test 6 includes a distance determination that was saved in the WORKING DATA FILE and then used in the locational attractiveness analysis.

20. COINCIDENTS ANALYSIS

The additional output (over initial job data) begins with the bold heading COINCIDENTS TABULATION and includes card column data entry images and a summary of options used and coincidents specifications. A coincidents matrix is output for each grouping category of the first data variable. Each output matrix is labeled with the grouping title and row and column legends are printed below the matrix. Test 7 is a coincidents analysis in which the grouping is by damage reaches, and the row and columns are existing and 1990 land use, respectively.

The values displayed are the number of acres which are coincident with the row (existing land use) and column (1990 land use) categories. The diagonal values in the matrix are the number of acres which have the same data class value for both data variables. Since both data variables are land use conditions, the diagonal values are the number of acres which have remained unchanged from the existing to the 1990 alternative future condition. The horizontal values are the number of acres which have changed from the row category to the column category. For example, Test 7, in row 1 (existing natural vegetation) damage reach 2 indicates that 106 acres which were classified as natural vegetation in existing conditions remained unchanged, 6 acres were converted to medium density housing, 41 acres to industrial land use, etc. Therefore, a complete accounting of damage reach 2 is made of the existing land use categories (natural vegetation) and how they changed to the 1990 future alternative land use pattern. The total amount of land classified as natural vegetation under existing conditions is 272 acres (sum of the values in row 1 and displayed in the last column of row 1) and the total amount of land classified as natural vegetation under 1990 conditions is 141 acres (sum of column 1 values and displayed as the last row value in the column).

21. REFERENCES

(1) Honey Hill, A Systems Analysis for Planning the Multiple Use of Controlled Water Areas, Institute for Water Resources, IWR report 71-9.

(2) Design with Nature, McHarg, Ian L., Natural History Press, Garden City, New York, 1969.

(3) GRID MANUAL Version 3, Laboratory for Computer Graphics and Spatial Analysis, Harvard University, October 1971.

EXHIBIT I

TEST/EXAMPLE PROBLEMS

RESOURCE INFORMATION AND ANALYSIS

Introduction

The seven test problems contained in this exhibit provide examples of input and output for a variety of problems that may be analyzed by the RIA program. Included in these problems are example uses of each of the four major analysis packages: Distance Determinations, Impact Assessments, Attractiveness Modeling, and Coincidents Tabulations. Selected printer display output options (Mapping Package) are included in the Distance Determinations and Attractiveness Modeling examples.

The test problems make use of the data bank that was developed for the Trail Creek Watershed in conjunction with the Phase I Oconee Basin Pilot Study (2). Trail Creek, which is approximately 12 sq.mi., is located near the city of Athens in Clarke County in northeast Georgia. Input decks for the test problems and a magnetic tape containing the BASE DATA FILE are available from the Hydrologic Engineering Center upon request. These test problems may be used to familiarize the user with the RIA program capabilities and to verify that the program is functioning properly by reproducing the results of the test problems.

Table I-1 contains the BASE DATA FILE directory. A BASE DATA FILE (data bank) directory is a listing of the data variables and associated categories that comprise the grid cell data file. The format for the BASE DATA FILE is (12F4.0, 2F8.2, 2F4.0, 2F2.0). There are 18 variables and each variable is catalogued in a grid cell array containing 92 rows and 129 columns.

The TEST/EXAMPLE problems are each defined by a test number and title, problem statement, discussion of input requirements and output solutions, and listing of computer input for and output from the test problems. An index to the test problems is contained on the next page.

TEST/EXAMPLE PROBLEM INDEX

TABLE I-1

BASE DATA FILE DIRECTORY

Variable Sequence Number

1 GRID CELL ROW

1 - Row 1
2-92 - Rows 2 - 92

2 GRID CELL COLUMN

1 - Column 1
2-129 - Columns 2 - 129

3 WATERSHED

1 - Trail Creek

4 HYDROLOGIC SUBBASIN CODES

1 - Subbasin 1
2-21 - Subbasins 2 - 21

5 DAMAGE REACH CODES

1 - Damage Reach 1
2-5 - Damage Reaches 2 - 5
6 - Outside Damage Reaches

6 SOIL IDENTIFICATION

1 = AN .. Appling Sandy Clay Loam

2 = AX .. Appling course sandy loam
3 = BFS .. Buncombe loamy sand

4 = CB . . Cecil soils
5 = CI . . Colfax sandy loam
6 = COA .. Congaree soils and alluvial land
7 = COB .. Chewacla soils and alluvial land
8 = CY . . Cecil sandy loam
9 = CZ . . Cecil sandy clay loam
10 = DH . . Davidson clay loam
11 = DQ . . Davidson sandy loam
12 = LD . . Louisburg stony loamy sand
13 = LN . . Louisburg loamy sand
14 = MG . . Madison sandy loam
15 = MI . . Madison sandy clay loam
16 = MM . . Madison - Louisa complex
17 = MV . . Musella clay loam
18 = PF . . Pacolet sandy loam
19 = PG . . Pacolet sandy clay loam
20 = PH . . Pacolet - Gullied land complex
21 = PI . . Pacolet stony sandy loam
22 = ROK .. Rock outcrop
23 = WK . . Worsham sandy loam
24 = WOS .. Wehadkee and alluvial land
25 = 00 . . Water

7 HYDROLOGIC SOIL GROUP

1 - Group A (Low Runoff Potential)
2 - Group B (Moderate Infiltration Rates)
3 - Group C (Slow Infiltration Rates)
4 - Group D (High Runoff Potential)

8 LAND SURFACE SLOPE

0 - Rock Outcrop
1 - 0 to 2 percent slope

2 - 2 to 6 percent slope
3 - 6 to 10 percent slope
4 - 10 to 15 percent slope
5 - 15 to 25 percent slope
6 - 25 to 45 percent slope
7 - Greater than 45 percent slope

9 EROSION CODE

0 - Little or no erosion
2 - Moderately eroded soils
3 - Severely eroded soils

10 EXISTING LAND USE

1 - Natural vegetation
2 - Developed open space
3 - Low density residential
4 - Medium density residential
5 - High density residential
6 - Agricultural
7 - Industrial
8 - Commercial
9 - Pasture
10 - Water bodies
11 - Outside study area

11 1990 ALTERNATIVE LAND USE PATTERN

1 - Natural vegetation
2 - Developed open space
3 - Low density residential
4 - Medium density residential
5 - High density residential

6 - Agricultural
7 - Industrial
8 - Commercial
9 - Pasture
10 - Water Bodies
11 - Outside study area

12 Unused variable location

13 REFERENCE FLOOD ELEVATION

Flood Elevations to the nearest .1 feet
are stored for each grid cell in the flood plain

14 TOPOGRAPHIC ELEVATION

Land elevations to the nearest .1 feet
are stored for each grid cell in the study area

15 Unused variable location

16 EXISTING LAND USE WITH PROPOSED 1500 ACRE PLANNED UNIT DEVELOPMENT

1 - Natural vegetation
2 - Developed open space
3 - Low density residential
4 - Medium density residential
5 - High density residential
6 - Agricultural
7 - Industrial
8 - Commercial
9 - Pasture
10 - Water bodies
11 - Outside study area

17 DISTANCE TO EXISTING HOUSING

0 - Housing located in this grid cell
1 - Cell centroid 200 feet from housing
2 - Cell centroid 400 feet from housing
3-23 - Cells centroids 600 to 4600 feet from housing

18 DISTANCE TO EXISTING INDUSTRY

0 - Industry located in this grid cell
1 - Cell centroid 200 feet from industry
2 - Cell centroid 400 feet from industry
3-23 - Cell centroids 600 to 4600 feet from industry

TEST 1

MAP DATA VARIABLE FROM BASE DATA FILE

Problem Statement

Obtain a line printer map display of the existing land use data variable (data variable No. 10) from the BASE DATA FILE. The land use categories should be identified by the numeric symbols corresponding to the BASE DATA FILE directory.

Description of Input Requirements

The basic input required to obtain a line printer map display of the existing land use data variable includes: 3 title cards, (T1-T3), the job specification (J1-J3) cards and the Mapping Package cards (M). The key input variables are: NGRPH (J1.5) which specifies that a display of a BASE DATA FILE variable will be made, NSKIP (J2.6) which indicates that a WORKING DATA FILE will be created (must be done to obtain map since this data bank is formatted) and NVAR (MP.1) which identifies the variable in the BASE DATA VILE to be mapped. The sublevel text flag (MP.3) is specified. A set of M4 (symbolism) cards are provided. The first M4 card specifies the symbolism and the remaining 3 are blank, i.e. no overprinting is specified. The sublevel text option is used to legend the output symbolism.

Discussion of the Results

Computer graphic display of the existing land use data variable numerically depicts the location of each of the 10 land use categories. The numeric symbol 1 corresponds to existing land use category one (natural vegetation), symbol 2 for category 2 (developed open space), etc. The total number of grid cells in each category and the percentage of the area thus represented is tabulated in the legend output below the map.

```
T1                                  TEST NO. 1
T2                        BASE DATA FILE VARIABLE DISPLAY
T3        DATA VARIABLE NO. 10  EXISTING LAND USE CONDITIONS
J1                                         1
J2      1       1      18      92     129       1
J3(12F4.0,2F8.2,2F4.0,2F2.0)
MP     10       0       1
M4
1234567890
```

3 BLANK CARDS

```
MS
                                    TEST NO. 1
                          BASE DATA FILE VARIABLE DISPLAY
          DATA VARIABLE NO. 10  EXISTING LAND USE CONDITIONS
ENDT
01
01        NATURAL VEGETATION
02
02        DEVOPED OPEN SPACE
03
03        LOW DENSITY HOUSING
04
04        MEDIUM DENSITY HOUSING
05
05        HIGH DENSITY HOUSING
06
06        AGRICULTURE
07
07        INDUSTRY
08
08        COMMERCIAL
09
09        PASTURE
10
10        WATER BODIES
99
ME
```

RIA

RESOURCE INFORMATION AND ANALYSIS
VERSION 1.0, SEPT.,1977

THE HYDROLOGIC ENGINEERING CENTER
U.S.ARMY CORPS OF ENGINEERS
609 SECOND ST.
DAVIS, CA. 95616

TEST NO. 1
BASE DATA FILE VARIABLE DISPLAY
DATA VARIABLE NO. 10 EXISTING LAND USE CONDITIONS

J1 CARD

```
CC 1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
   J1      0       0       0       0       1
```

THIS JOB WILL PERFORM THE FOLLOWING

NUMBER OF DISTANCE DETERMINATIONS (NSRCH) = 0

NUMBER OF IMPACT ASSESSMENTS (NIM) = 0

NUMBER OF ATTRACTIVENESS MODELS (NAM) = 0

NUMBER OF COINCIDENTS TABULATIONS (NCOMB) = 0

NUMBER OF MAPS FROM THE DATA FILE (NGRPH) = 1

J2 CARD

```
CC 1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
   J2      1       1      18      92     129       1       0
```

DATA FILE INFORMATION

THE COMPUTER FILE THE BASE DATA FILE IS ON (NFILE) = 1

THE NUMBER OF DATA VARIABLES IN THE BASE DATA FILE (NDV) = 18

THE NUMBER OF DATA VARIABLES IN THE WORKING DATA FILE (NN) = 18

THE NUMBER OF ROWS (NROWS) = 92   THE NUMBER OF COLUMNS (NCOL) = 129

THE WORKING DATA FILE WILL BE CREATED (NSKIP) = 1

THE BASE DATA FILE IS FORMATTED (NFORM) = 1

J3 CARD

```
CC 1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
   J3(12F4.0,2F8.2,2F4.0,2F2.0)
```

```
************************************************
*                                              *
*             X   X  XXX  XXXX                 *
*             XX XX X   X X   X                *
*             X X X X   X XXXX                 *
*             X   X XXXXX X                    *
*             X   X X   X X                    *
*                                              *
* XXXX   XXX   XXX  X   X  XXX   XXX  XXXXX    *
* X   X X   X X   X X  X  X   X X   X X        *
* XXXX  X   X X     XXX   X   X X     XXX      *
* X     XXXXX X   X X  X  XXXXX X  XX X        *
* X     X   X  XXX  X   X X   X  XXXX XXXXX    *
*                                              *
************************************************
```

```
                       MP CARD
                       *******
CC 12345678901234567890123456789012345678901234567890123456789012345678901234567890
   MP    10        0        1        0
```

DATA VARIABLE MAPPED (NVAR) =   10

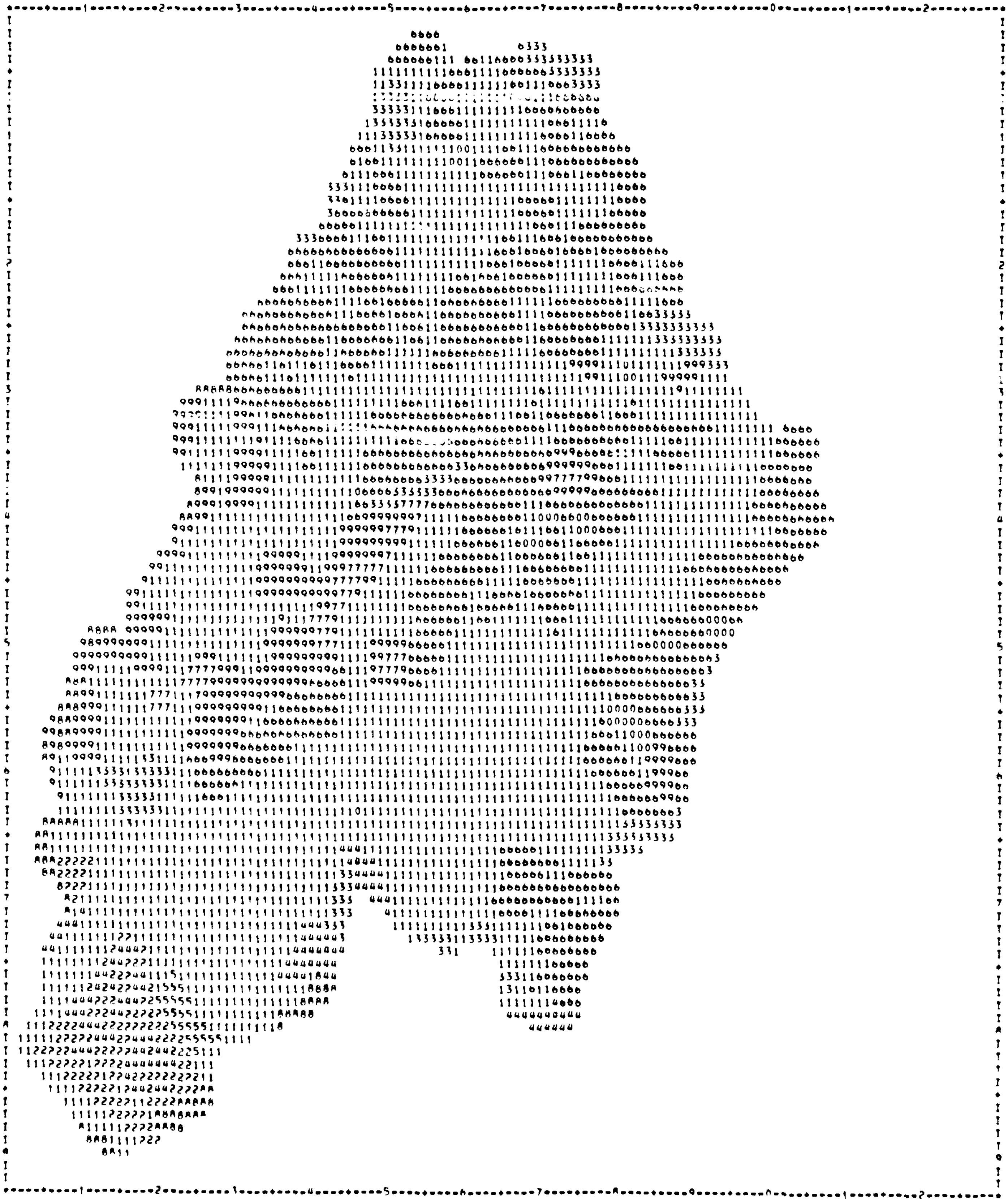
MINIMUM VALUE MAPPED (MINV) = 0

SUBLEVEL TEXT FLAG (ISUBT) = 1

LINE CARRIAGE CONTROL (LCAR) = 0

```
M4 OPTION(SYMBOLS)
******************

                             1                   2
LEVEL        1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
             * * * * * * * * * * * * * * * * * * * * * * * * *
OVERPRINT1   1 2 3 4 5 6 7 8 9 0
OVERPRINT2
OVERPRINT3
OVERPRINT4
```



TEST NO. 1
BASE DATA FILE VARIABLE DISPLAY
DATA VARIABLE NO. 10 EXISTING LAND USE CONDITIONS

DATA VALUE EXTREMES ARE 1.000 10.000

LEVEL NUMBER	SYMBOL	VALUE RANGE	PERCENT VALUE RANGE	FREQUENCY	PERCENTILE RANGE	PERCENT OF AREAS	
1	11111111 11111111 11111111	1.000 1.900	10.00	2785	0.00 52.34	52.34	NATURAL VEGETATION
2	22222222 22222222 22222222	1.900 2.800	10.00	139	52.34 54.95	2.61	DEVOPED OPEN SPACE
3	33333333 33333333 33333333	2.800 3.700	10.00	206	54.95 58.82	3.87	LOW DENSITY HOUSING
4	44444444 44444444 44444444	3.700 4.600	10.00	124	58.82 61.15	2.33	MEDIUM DENSITY HOUSING
5	55555555 55555555 55555555	4.600 5.500	10.00	24	61.15 61.60	.45	HIGH D[illegible]ITY HOUSING
6	66666666 66666666 66666666	5.500 6.400	10.00	1493	61.60 89.66	28.06	AGRICULTURE
7	77777777 77777777 77777777	6.400 7.300	10.00	55	89.66 90.70	1.03	INDUSTRY
8	88888888 88888888 88888888	7.300 8.200	10.00	86	90.70 92.31	1.62	COMMERCIAL
9	99999999 99999999 99999999	8.200 9.100	10.00	364	92.31 99.15	6.84	PASTURE
10	00000000 00000000 00000000	9.100 10.000	10.00	45	99.15 100.00	.85	WATER BODIES

TEST 2

DISTANCE DETERMINATION - SINGLE VARIABLE

Problem Statement

A regional planning commission is interested in determining desirable future industrial locations. One criteria of the planning commission is to locate the potential industrial air and sound pollution sources as far as possible from existing residential housing. Using the Distance Determination Package determine the minimum distance of each grid cell in the study area from those cells assigned land use categories associated with residential housing. Use the existing conditions land use pattern (data variable 10) to perform the analysis.

Description of Input Requirements

The usual title and job cards are required. The key input variables used in determining potential industrial locations removed from existing residential housing are: NSRCH (J1.1) which specifies the number of distance determinations to be made; NV (D1.1) used to specify the number of spatial data variables used in the distance determination; the output form desired (graphic not number map, D1.2), the cell dimensions (D1.3 and D1.4) and radius interval (D1.5). The subfield values (IRC) on the D2 cards associated with low, medium and high density residential housing categories of the existing land use pattern are assigned values of 1 to designate that distance determinations will be performed for these data variable categories. Map Package (M) cards are provided to display the output. The default options for mapping are used except that 20 mapping levels rather than the default of 10 are specified.

Data variable 17 in the BASE DATA FILE was created by a similar run and saved as a new data variable.

Discussion of Results

The graphic map indicates the distance determination results based on various levels of grey shading and numeric symbolism. The areas plotted as decimal points are grid cells assigned with distance intervals up to 1.15 so includes existing residential housing cells and cells within about 200 feet and the areas plotted as asterisks are those grid cells farthest removed from residential housing.

The distance calculations were specified to be grouped into discrete 200 foot intervals (radius interval input) so that the cells shown with level 20 symbolism (*) with a minimum value of 21.85 (truncated to 21) are at least 4200 feet (21 x 200) from a residential cell.

```
T1                                TEST NO. 2
T2                          LOCATION DISTANCE DETERMINATION
T3                        DISTANCE FROM RESIDENTIAL HOUSING
J1      1
J2      1       1       18       92      129
J3(12F4.0,2F8.2,2F4.0,2F2.0)
D1      1       2      200      333      200DISTANCE 200 FT. INTERVALS
D2     10 0 0 0 1 1 1 0 0 0 0 0                            EXISTING LAND USE
MP
M2     20
MS
ENDT
ME
```

RIA

RESOURCE INFORMATION AND ANALYSIS
VERSION 1.0, SEPT.,1977

THE HYDROLOGIC ENGINEERING CENTER
U.S.ARMY CORPS OF ENGINEERS
609 SECOND ST.
DAVIS, CA. 95616

TEST NO. 2
LOCATION DISTANCE DETERMINATION
DISTANCE FROM RESIDENTIAL HOUSING

J1 CARD

```
CC 12345678901234567890123456789012345678901234567890123456789012345678901234567890
   J1     1       0       0       0       0
```

THIS JOB WILL PERFORM THE FOLLOWING

NUMBER OF DISTANCE DETERMINATIONS (NSRCH) = 1

NUMBER OF IMPACT ASSESSMENTS (NIM) = 0

NUMBER OF ATTRACTIVENESS MODELS (NAM) = 0

NUMBER OF COINCIDENTS TABULATIONS (NCOMB) = 0

NUMBER OF MAPS FROM THE DATA FILE (NGRPH) = 0

J2 CARD

```
CC 12345678901234567890123456789012345678901234567890123456789012345678901234567890
   J2     1       1      18      92     129       0       0
```

DATA FILE INFORMATION

THE COMPUTER FILE THE BASE DATA FILE IS ON (NFILE) = 1

THE NUMBER OF DATA VARIABLES IN THE BASE DATA FILE (NDV) = 18

THE NUMBER OF DATA VARIABLES IN THE WORKING DATA FILE (NN) = 18

THE NUMBER OF ROWS (NROWS) = 92 THE NUMBER OF COLUMNS (NCOL) = 129

THE WORKING DATA FILE WILL NOT BE CREATED (NSKIP) = 0

THE BASE DATA FILE IS FORMATTED (NFORM) = 1

J3 CARD

```
CC 12345678901234567890123456789012345678901234567890123456789012345678901234567890
   J3(12F4.0,2F8.2,2F4.0,2F2.0)
```

```
*******************************************************************************
*                                                                             *
*                XXXX  XXX  XXX  XXXXX  XXX  X   X  XXXX XXXXX                *
*                X   X  X  X       X   X   X XX  X X     X                    *
*                X   X  X   XXX    X   X   X X X X X     XXX                  *
*                X   X  X      X   X   XXXXX X  XX X     X                    *
*                XXXX  XXX  XXX    X   X   X X   X  XXXX XXXXX                *
*                                                                             *
*  XXXX  XXXXX XXXXX XXXXX XXXX  X   X XXX X   X  XXX  XXXXX XXX  XXX  X   X  *
*  X   X X       X   X     X   X XX XX  X  XX  X X   X   X    X  X   X XX  X  *
*  X   X XXXX    X   XXXX  XXXX  X X X  X  X X X X   X   X    X  X   X X X X  *
*  X   X X       X   X     X  X  X   X  X  X  XX XXXXX   X    X  X   X X  XX  *
*  XXXX  XXXXX   X   XXXXX X   X X   X XXX X   X X   X   X   XXX  XXX  X   X  *
*                                                                             *
*******************************************************************************
```

DISTANCE CALCULATION NO. 1

DISTANCE 200 FT. INTERVALS

```
                       D1 CARD
                       -------

CC 12345678901234567890123456789012345678901234567890123456789012345678901234567890
   D1     1       2    200.    333.    200.DISTANCE 200 FT. INTERVALS

                          FOR THIS DISTANCE DETERMINATION
                       ------------------------------------

                       THE NUMBER OF DATA VARIABLES (NV) = 1

                       THE GRAPHIC OPTION (OPTG) = 2 (GRID MAP)

                       THE GRID CELL DIMENSIONS ARE
                       XLEN = 200.0      YLEN = 333.0

                       THE DISTANCE INTERVAL IS  200. FEET


                       D2 CARDS
                       --------
CC 12345678901234567890123456789012345678901234567890123456789012345678901234567890
   D2     10 0 0 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0EXISTING LAND USE


**********************************************************************************************
*                      THE FOLLOWING DATA VARIABLES                                          *
*                           ARE BEING SEARCHED                                               *
**********************************************************************************************
*   VAR   *              RECODING FOR CLASSES                    *                           *
*   ID.   *   0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3    *          VARIABLE         *
*  -----  *   -----------------------------------------------    *  ------------------------ *
*         *                                                      *                           *
*   10    *   0 0 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0    *     EXISTING LAND USE     *
*         *                                                      *                           *
**********************************************************************************************


                 A RECODING VALUE OF ONE MEANS TO ASSIGN GRID CELLS
                 WITH THAT DATA CLASS A DISTANCE VALUE OF ZERO,
                 AND ALL OTHER CELLS HAVE A DISTANCE VALUE ASSIGNED
                 BASED ON HOW FAR AWAY IT IS FROM THE CLOSEST
                 ZERO VALUED CELL.
```

```
***********************************************
*                                             *
*              X   X  XXX  XXXX               *
*              XX XX X   X X   X              *
*              X X X X   X XXXX               *
*              X   X XXXXX X                  *
*              X   X X   X X                  *
*                                             *
*  XXXX   XXX   XXX  X   X  XXX   XXX  XXXXX  *
*  X   X X   X X   X X  X  X   X X   X X      *
*  XXXX  X   X X     XXX   X   X X     XXX    *
*  X     XXXXX X   X X  X  XXXXX X  XX X      *
*  X     X   X  XXX  X   X X   X  XXXX XXXXX  *
*                                             *
***********************************************
```

```
                 MP CARD
                 -------
CC 12345678901234567890123456789012345678901234567890123456789012345678901234567890
   MP     0      0      0      0
```

DATA VARIABLE MAPPED (NVAR) =   0

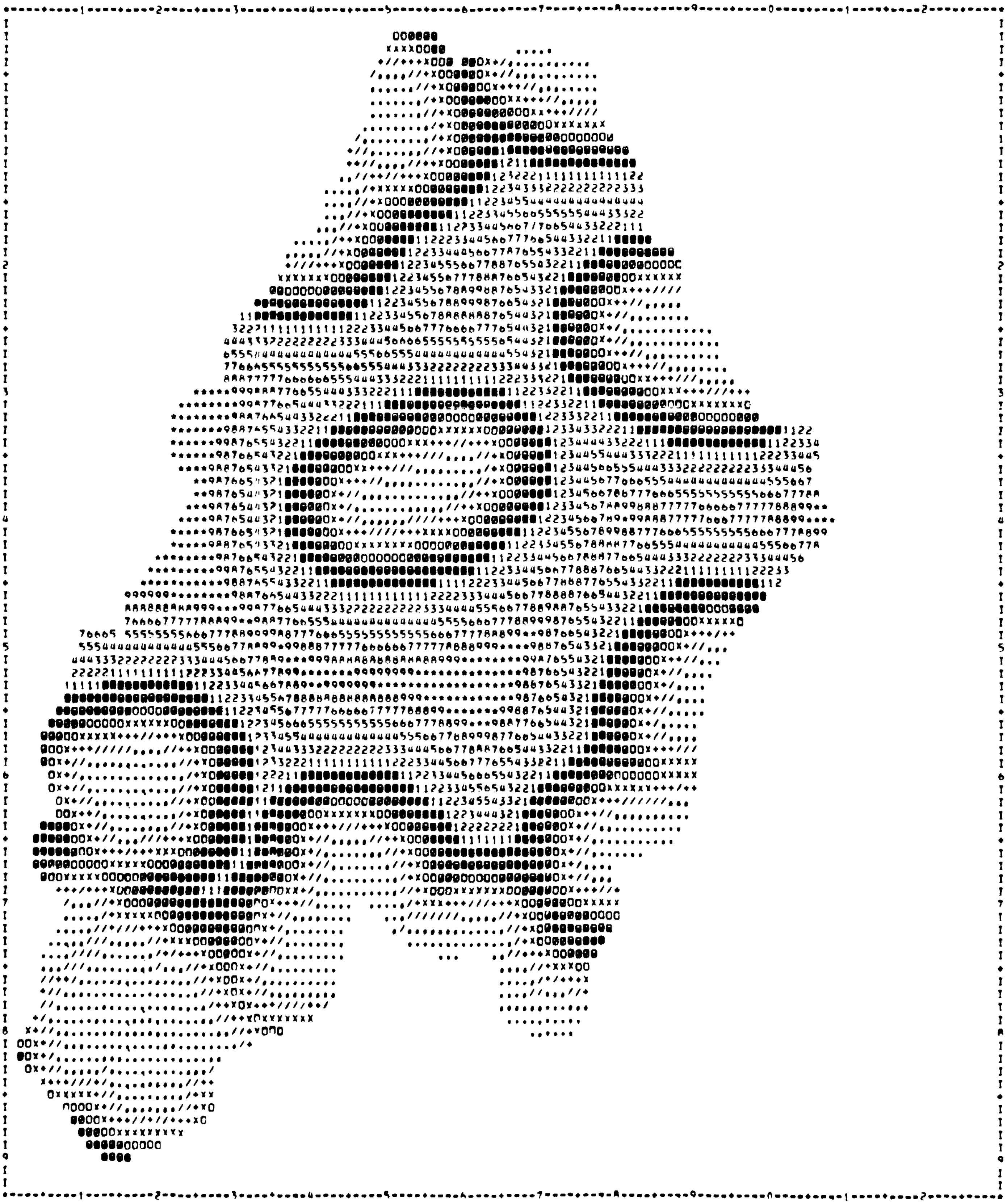
MINIMUM VALUE MAPPED (MINV) = 0

SUBLEVEL TEXT FLAG (ISUBT) = 0

LINE CARRIAGE CONTROL (LCAR) = 0

M2 OPTION(LEVELS)

NUMBER OF MAP LEVELS = 20



DATA VALUE EXTREMES ARE 0.000 23.000

LEVEL NUMBER	SYMBOL	VALUE RANGE	PERCENT VALUE RANGE	FREQUENCY	PERCENTILE RANGE	PERCENT OF AREAS
1	....	0.000 – 1.150	5.00	501	0.00 – 9.39	9.39
2	....	1.150 – 2.300	5.00	323	9.39 – 15.44	6.05
3	////////	2.300 – 3.450	5.00	311	15.44 – 21.26	5.83
4	++++++++	3.450 – 4.600	5.00	271	21.26 – 26.34	5.08
5	XXXXXXXX	4.600 – 5.750	5.00	293	26.34 – 31.83	5.49
6	OOOOOOOO	5.750 – 6.900	5.00	342	31.83 – 38.24	6.41
7	@@@@@@@@	6.900 – 8.050	5.00	277	38.24 – 43.42	5.19
8	████████	8.050 – 9.200	5.00	307	43.42 – 49.18	5.75
9	████████	9.200 – 10.350	5.00	288	49.18 – 54.57	5.40
10	████████	10.350 – 11.500	5.00	219	54.57 – 58.67	4.10
11	11111111	11.500 – 12.650	5.00	272	58.67 – 63.77	5.10
12	22222222	12.650 – 13.800	5.00	298	63.77 – 69.35	5.58
13	33333333	13.800 – 14.950	5.00	212	69.35 – 73.32	3.97
14	44444444	14.950 – 16.100	5.00	282	73.32 – 78.61	5.28
15	55555555	16.100 – 17.250	5.00	245	78.61 – 83.20	4.59
16	66666666	17.250 – 18.400	5.00	214	83.20 – 87.20	4.01
17	77777777	18.400 – 19.550	5.00	189	87.20 – 90.75	3.54
18	88888888	19.550 – 20.700	5.00	184	90.75 – 94.19	3.45
19	99999999	20.700 – 21.850	5.00	116	94.19 – 96.37	2.17
20	********	21.850 – 23.000	5.00	194	96.37 – 100.00	3.63

TEST 3

IMPACT ASSESSMENT - TWO VARIABLES

Problem Statement

A hydrologist has determined that land use and soil type have the most impact on surface runoff and wishes to locate the areas where the most critical runoff might occur. Using the existing land use conditions (data variable 10) and the hydrologic soil groups (data variable 7) determine the areas where these two factors may have the greatest impact on surface runoff. Use the standard matrix to perform the assessment.

Description of Input Requirements

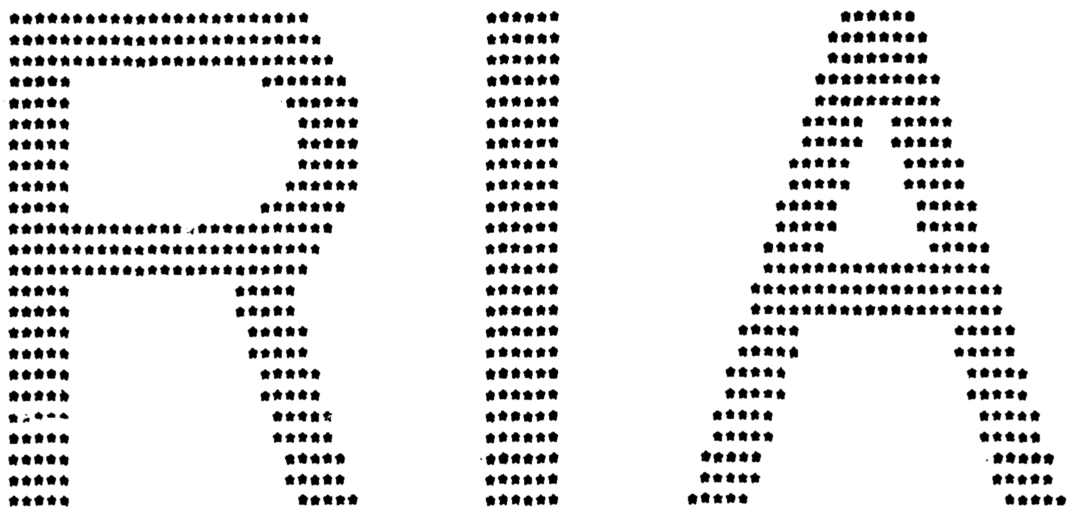
The usual title and job cards are required. The key input variables used to determine the critical potential runoff areas are: NIM (J1.2) used to indicate the number of impact assessments to be performed: NVAR (I1.1) which specifies the number of variables to be used; MATX1 (I1.2) which indicates only one matrix (final matrix) will be used in the assessment; and MATX2 (I1.3) which specifies the Standard 1 option will be used to create the final matrix. IMP (I2.1), NVARDB (I2.2) and RECODE (I2.3 to I2.8) specify the rank importance of each variable, the sequential order in the BASE DATA FILE and reclassify the categories of each of the two data variables used in the analysis based on potential impact of each data variable category. Map (M) cards are included specifying printer plot output. Note that the M1 card is used to specify the value range for plotting and also that additional text and sublevel text is provided.

Discussion of the Results

The Impact assessment results include a listing of the impact recording classes for each of the data variables, the final matrix used, and a summary of the number of grid cells assigned to each potential impact value (Extreme, Severe, etc.). Notice that 17 cells are indicated to be rejected (-1) but none were so coded. This occurred because one or both of the variables did not exactly cover the study boundary and background (not in study area) values of -1 for a few cells were picked up. By specifying -2 for MINV (MP.2) those cells are printed as L's.

Note also that the low and high values are specified (M1.2 and M1.4) as 0 and 10 respectively. This was done to assure that the mapping levels and symbolism would correspond with the tabulated Analysis Results. The light shaded areas are those of least impact and the dark shaded areas those of greatest (Extreme) impact.

```
T1                          TEST NO. 3
T2            IMPACT ANALYSIS TEST OF TWO DATA VARIABLES
T3                     IMPACT ON SURFACE RUNOFF
J1     0       1       0       0       0       0
J2     1       1      18      92     129
J3(12F4.0,2F8.2,2F4.0,2F2.0)
IT
IT               IMPACT ANALYSIS OF EXISTING LAND USE
IT                       ON SURFACE RUNOFF
I1     2      -1       1
I2     1      10 0 4 4 4 3 2 3 2 1 4 1                       EXIST. LAND USE
I2     2       7 0 1 2 3 4                                   HYD. SOIL GRP.
MP     0      -2       1       0
M1     1       0       1      10
MS
                         IMPACT ANALYSIS TEST
                          OF SURFACE RUNOFF
ENDT
00
00     REJECTED CELLS
01
01     NO POTENTIAL IMPACT
03
03     SLIGHT POTENTIAL IMPACT
05
05     MODERATE POTENTIAL IMPACT
07
07     SEVERE POTENTIAL IMPACT
10
10     EXTREME POTENTIAL IMPACT
99
ME
```



RESOURCE INFORMATION AND ANALYSIS
VERSION 1.0, SEPT.,1977

THE HYDROLOGIC ENGINEERING CENTER
U.S.ARMY CORPS OF ENGINEERS
609 SECOND ST.
DAVIS, CA. 95616

TEST NO. 3
IMPACT ANALYSIS TEST OF TWO DATA VARIABLES
IMPACT ON SURFACE RUNOFF

J1 CARD

```
CC 12345678901234567890123456789012345678901234567890123456789012345678901234567890
   J1      0       1       0       0       0
```

THIS JOB WILL PERFORM THE FOLLOWING

NUMBER OF DISTANCE DETERMINATIONS (NSRCH) = 0

NUMBER OF IMPACT ASSESSMENTS (NIM) = 1

NUMBER OF ATTRACTIVENESS MODELS (NAM) = 0

NUMBER OF COINCIDENTS TABULATIONS (NCOMB) = 0

NUMBER OF MAPS FROM THE DATA FILE (NGRPH) = 0

J2 CARD

```
CC 12345678901234567890123456789012345678901234567890123456789012345678901234567890
   J2      1       1      18      92     129       0       0
```

DATA FILE INFORMATION

THE COMPUTER FILE THE BASE DATA FILE IS ON (NFILE) = 1

THE NUMBER OF DATA VARIABLES IN THE BASE DATA FILE (NDV) = 18

THE NUMBER OF DATA VARIABLES IN THE WORKING DATA FILE (NN) = 18

THE NUMBER OF ROWS (NROWS) = 92   THE NUMBER OF COLUMNS (NCOL) = 129

THE WORKING DATA FILE WILL NOT BE CREATED (NSKIP) = 0

THE BASE DATA FILE IS FORMATTED (NFORM) = 1

J3 CARD

```
CC 12345678901234567890123456789012345678901234567890123456789012345678901234567890
   J3(12F4.0,2F8.2,2F4.0,2F2.0)
```

```
**************************************************
*                                                *
*        XXX X   X XXXX   XXX   XXXX XXXXX       *
*         X  XX XX X   X X   X X       X         *
*         X  X X X XXXX  X   X X       X         *
*         X  X   X X     XXXXX X       X         *
*        XXX X   X X     X   X  XXXX   X         *
*                                                *
*   XXX  X   X XXX  X   X  XXX  XXX  XXX  XXX    *
*  X     XX XX X  X X   X X   X X    X    X      *
*  X     X X X X  X X   X  XXX  XXX  X     XXX   *
*  X XXX X   X XXXXX X  X    X  X    X        X  *
*  X   X X   X X   X XXXXX X    XXX  XXX  XXX    *
*                                                *
**************************************************
```

IMPACT ANALYSIS OF EXISTING LAND USE
ON SURFACE RUNOFF

```
                   I1 CARD
                   -------
CC 1234567890123456789012345678901234567890123456789012345678901234567890123456789O
   I1     2      -1      1
```

THIS IS A TWO VARIABLE ANALYSIS WHICH REQUIRES
ONLY A FINAL IMPACT MATRIX

THE FINAL MATRIX IS STANDARD MATRIX NO. 1

```
                   I2 CARDS
                   --------
CC 12345678901234567890123456789012345678901234567890123456789012345678901234567890
   I2     1      10 0 4 4 4 3 2 3 2 1 4 1 0 0 0 0 0 0 0 0 0 0 0 0EXIST, LAND USE
   I2     2       7 0 1 2 3 4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0HYD, SOIL GRP,
```

THIS ANALYSIS USES THE FOLLOWING DATA VARIABLES

VAR. IMP.	DATA BANK VAR.	IMPACT RECODING FOR CLASSES 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	VARIABLE TITLE
1	10	0	4	4	4	3	2	3	2	1	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	EXIST, LAND USE
2	7	0	1	2	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	HYD, SOIL GRP,

A RECODING VALUE OF 1 IS EXTREME IMPACT, 2 IS SEVERE, 3 IS MODERATE,
4 IS SLIGHT AND 5 IS NULL OR NO IMPACT,

FINAL MATRIX

IMPACT POTENTIAL	(1) EXT.	(2) SEV.	(3) MOD.	(4) SLT.	(5) NULL
(1) EXT.	EXT.	EXT.	SEV.	SEV.	MOD.
(2) SEV.	EXT.	SEV.	SEV.	MOD.	MOD.
(3) MOD.	SEV.	SEV.	MOD.	MOD.	SLT.
(4) SLT.	SEV.	MOD.	MOD.	SLT.	SLT.
(5) NULL	MOD.	MOD.	SLT.	SLT.	NULL

THE COLUMNS ARE THE IMPACT POTENTIALS OF THE MOST IMPORTANT VARIABLE (EXIST. LAND USE)

THE ROWS ARE THE IMPACT POTENTIALS OF THE SECOND MOST IMPORTANT VARIABLE(HYD. SOIL GRP.)

ANALYSIS RESULTS

FINAL IMPACT	EXT.	SEV.	MOD.	SLT.	NULL	REJ.
NUMBER OF GRID CELLS	121.	1662.	3482.	56.	0.	17.
DATA VALUE	10	7	5	3	0	-1

```
************************************************
*                                              *
*              X   X  XXX  XXXX                *
*              XX XX X   X X   X               *
*              X X X X   X XXXX                *
*              X   X XXXXX X                   *
*              X   X X   X X                   *
*                                              *
*  XXXX   XXX   XXX  X   X  XXX   XXX  XXXXX   *
*  X   X X   X X   X X  X  X   X X   X X       *
*  XXXX  X   X X     XXX   X   X X     XXX     *
*  X     XXXXX X   X X  X  XXXXX X  XX X       *
*  X     X   X  XXX  X   X X   X  XXXX XXXXX   *
*                                              *
************************************************
```

```
                MP CARD
                -------
CC 12345678901234567890123456789012345678901234567890123456789012345678901234567890
   MP      0      -2       1       0
```

DATA VARIABLE MAPPED (NVAR) =   0

MINIMUM VALUE MAPPED (MINV) = -2

SUBLEVEL TEXT FLAG (ISUBT) = 1

LINE CARRIAGE CONTROL (LCAR) = 0

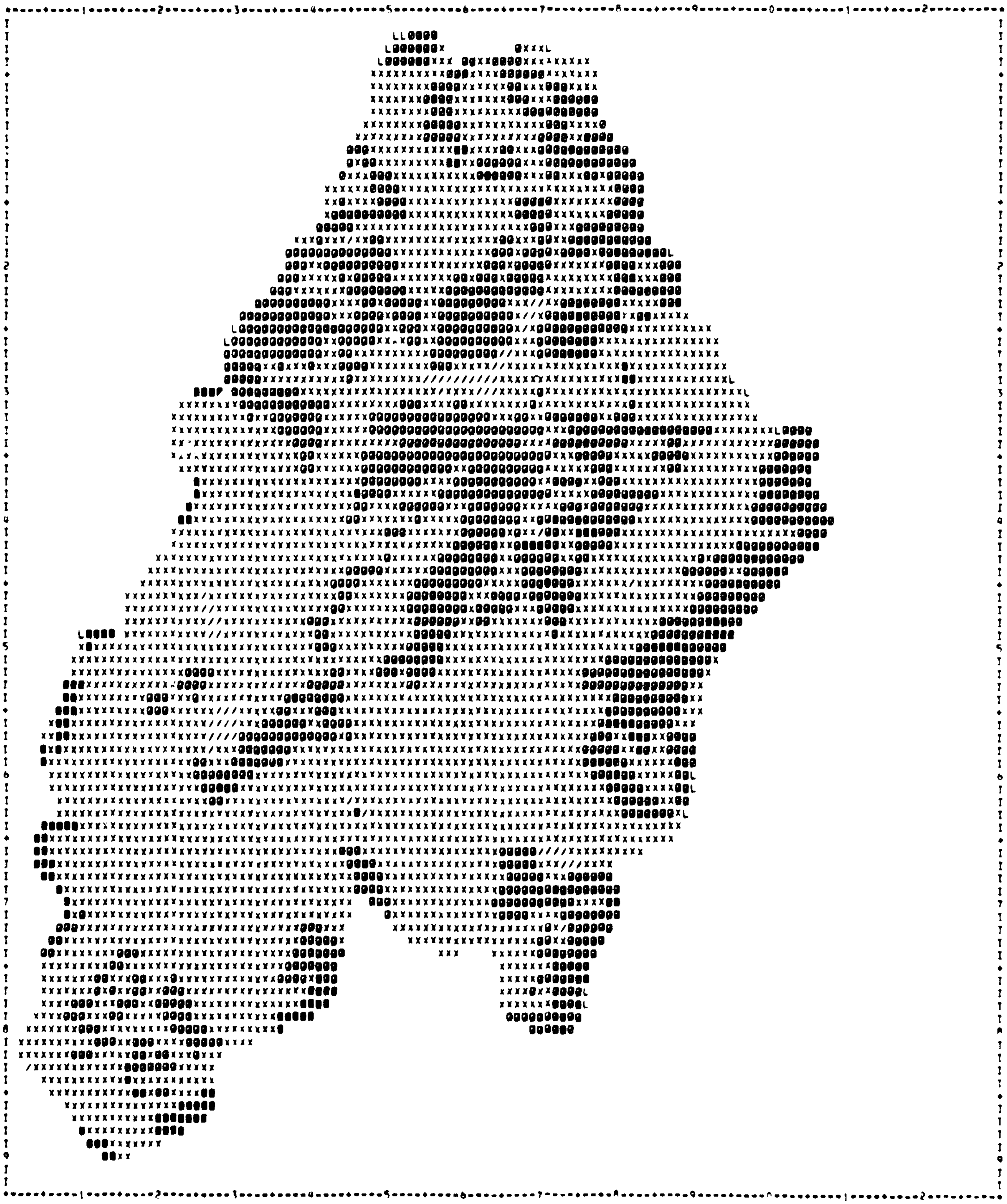
M1 OPTION(LOW AND HIGH VALUES)

MINIMUM FLAG = 1

MINIMUM VALUE = 0.0

MAXIMUM FLAG = 1

MAXIMUM VALUE =10.0



IMPACT ANALYSIS TEST
OF SURFACE RUNOFF

DATA VALUE EXTREMES ARE 0.000 10.000

LEVEL NUMBER	SYMBOL	VALUE RANGE	PERCENT VALUE RANGE	FREQUENCY	PERCENTILE RANGE	PERCENT OF AREAS	
LOW	LLLLLLLL	0.000 – 0.000		17	0.00 – .32	.32	REJECTED CELLS
1	....	0.000 – 1.000	10.00	0	.32 – .32	0.00	NO POTENTIAL IMPACT
2	....	1.000 – 2.000	10.00	0	.32 – .32	0.00	
3	////////	2.000 – 3.000	10.00	56	.32 – 1.37	1.05	SLIGHT POTENTIAL IMPACT
4	++++++++	3.000 – 4.000	10.00	0	1.37 – 1.37	0.00	
5	XXXXXXXX	4.000 – 5.000	10.00	3482	1.37 – 66.60	65.23	MODERATE POTENTIAL IMPACT
6	OOOOOOOO	5.000 – 6.000	10.00	0	66.60 – 66.60	0.00	
7	@@@@@@@@	6.000 – 7.000	10.00	1662	66.60 – 97.73	31.14	SEVERE POTENTIAL IMPACT
8	@@@@@@@@	7.000 – 8.000	10.00	0	97.73 – 97.73	0.00	
9	████████	8.000 – 9.000	10.00	0	97.73 – 97.73	0.00	
10	████████	9.000 – 10.000	10.00	121	97.73 – 100.00	2.27	EXTREME POTENTIAL IMPACT
HIGH	HHHHHHHH	10.000 – 10.000		0	100.00 – 100.00	0.00	

TEST 4

IMPACT ASSESSMENT - THREE VARIABLES

Problem Statment

Potential groundwater pollution is associated with the source of pollution (land use), time available for infiltration (slope) and soil permeability (hydrologic soil group). Using these three data variables develop the impact matrices and display the areas with the highest potential for groundwater pollution.

Description of Input Requirements

The usual title and job cards are required. The key input variables used in the assessments of potential groundwater pollution sources are: NIM (J1.2) used to indicate the number of input assessments to be performed; NVAR (I1.1 equal to 3) which specifies the number of data variables used in the analysis; and IMP (I2.1) which indicates the row and column designation of each data variable in constructing the initial and final matrices; and RECODE(I) (I2.3 to I2.8) designating impact potential. Five IM and FM cards are required (I1.2 and I1.3) for user specification of the impact potential assignments for the initial and final matrices, respectively. The map options used are similar to TEST 3 to assure correspondence between the display and ANALYSIS RESULTS.

Discussion of the Results

The results include a listing of the potential impact assignments of each data variable and associated data variable categories, the initial and final matrices, and a computer graphic display of the results of the final matrix. The map indicates areas of high ground water pollution potential impact with the darker the shade the greater the impact potential.

```
T1                                     TEST NO.4
T2              IMPACT ANALYSIS TEST OF THREE DATA VARIABLES
T3                     POTENTIAL GROUND WATER POLLUTION
J1      0       1       0       0       C       0
J2      1       1       18      92      129
J3(12F4.0,2F8.2,2F4.0,2F2.0)
IT                           IMPACT ANALYSIS TEST
IT                     POTENTIAL GROUNDWATER POLLUTION
IT
I1      3       0       0
I2      1       7 0 1 2 3 4                                            HYDROLOGIC SOIL
I2      2       8 5 1 2 2 3 4 5 5                                      SLOPE
I2      3      10 0 5 5 4 3 2 1 1 1 5 5                                LAND USE
IM      1       1       2       3       4
IM      1       2       2       3       4
IM      2       2       3       3       4
IM      2       2       3       3       4
IM      2       3       3       4       5
FM      1       1       2       3       4
FM      1       2       2       3       4
FM      2       2       3       3       4
FM      2       2       3       3       4
FM      2       3       3       4       5
MP      0       0       1
M1      1       0       1      10
MS
                       POTENTIAL GROUND WATER POLLUTION
ENDT
01
01       NO POTENTIAL IMPACT
03
03       SLIGHT POTENTIAL IMPACT
05
05       MODERATE POTENTIAL IMPACT
07
07       SEVERE POTENTIAL IMPACT
10
10       EXTREME POTENTIAL IMPACT
99
ME
```

RIA

RESOURCE INFORMATION AND ANALYSIS
VERSION 1.0, SEPT.,1977

THE HYDROLOGIC ENGINEERING CENTER
U.S.ARMY CORPS OF ENGINEERS
609 SECOND ST.
DAVIS, CA. 95616

TEST NO. 4
IMPACT ANALYSIS TEST OF THREE DATA VARIABLES
POTENTIAL GROUND WATER POLLUTION

J1 CARD

```
CC 1234567890123456789012345678901234567890123456789012345678901234567890
   J1      0         1         0         0         0
```

THIS JOB WILL PERFORM THE FOLLOWING

NUMBER OF DISTANCE DETERMINATIONS (NSRCH) = 0

NUMBER OF IMPACT ASSESSMENTS (NIM) = 1

NUMBER OF ATTRACTIVENESS MODELS (NAM) = 0

NUMBER OF COINCIDENTS TABULATIONS (NCOMB) = 0

NUMBER OF MAPS FROM THE DATA FILE (NGRPH) = 0

J2 CARD

```
CC 1234567890123456789012345678901234567890123456789012345678901234567890
   J2      1         1        18        92       129         0         0
```

DATA FILE INFORMATION

THE COMPUTER FILE THE BASE DATA FILE IS ON (NFILE) = 1

THE NUMBER OF DATA VARIABLES IN THE BASE DATA FILE (NDV) = 18

THE NUMBER OF DATA VARIABLES IN THE WORKING DATA FILE (NN) = 18

THE NUMBER OF ROWS (NROWS) = 92   THE NUMBER OF COLUMNS (NCOL) = 129

THE WORKING DATA FILE WILL NOT BE CREATED (NSKIP) = 0

THE BASE DATA FILE IS FORMATTED (NFORM) = 1

J3 CARD

```
CC 1234567890123456789012345678901234567890123456789012345678901234567890
   J3(12F4.0,2F8.2,2F4.0,2F2.0)
```

IMPACT ANALYSIS TEST
POTENTIAL GROUNDWATER POLLUTION

I1 CARD

```
CC 1234567890123456789012345678901234567890123456789012345678901234567890
 I1     3       0       0
```

THIS IS A THREE VARIABLE ANALYSIS WHICH REQUIRES
BOTH AN INITIAL AND A FINAL IMPACT MATRIX

THE INITIAL MATRIX IS USER DEFINED

THE FINAL MATRIX IS USER DEFINED

I2 CARDS

```
CC 1234567890123456789012345678901234567890123456789012345678901234567890
 I2     1       7 0 1 2 3 4 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0HYDROLOGIC SOIL
 I2     2       8 5 1 2 2 3 4 5 5 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0SLOPE
 I2     3      10 0 5 5 4 3 2 1 1 1 5 5 0 0 0 0 0 0 0 0 0 0 0 0 0LAND USE
```

THIS ANALYSIS USES THE FOLLOWING DATA VARIABLES

VAR. IMP.	DATA BANK VAR.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	VARIABLE TITLE
		IMPACT RECODING FOR CLASSES																								
1	7	0	1	2	3	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	HYDROLOGIC SOIL
2	8	5	1	2	2	3	4	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	SLOPE
3	10	0	5	5	4	3	2	1	1	1	5	5	0	0	0	0	0	0	0	0	0	0	0	0	0	LAND USE

A RECODING VALUE OF 1 IS EXTREME IMPACT, 2 IS SEVERE, 3 IS MODERATE,
4 IS SLIGHT AND 5 IS NULL OR NO IMPACT.

IM CARDS

```
CC 1234567890123456789012345678901234567890123456789012345678901234567890
 IM     1.      1.      2.      3.      4.
 IM     1.      2.      2.      3.      4.
 IM     2.      2.      3.      3.      4.
 IM     2.      2.      3.      3.      4.
 IM     2.      3.      3.      4.      5.
```

INITIAL MATRIX

IMPACT POTENTIAL	(1) EXT.	(2) SEV.	(3) MOD.	(4) SLT.	(5) NULL
(1) EXT.	EXT.	EXT.	SEV.	MOD.	SLT.
(2) SEV.	EXT.	SEV.	SEV.	MOD.	SLT.
(3) MOD.	SEV.	SEV.	MOD.	MOD.	SLT.
(4) SLT.	SEV.	SEV.	MOD.	MOD.	SLT.
(5) NULL	SEV.	MOD.	MOD.	SLT.	NULL

THE COLUMNS ARE THE IMPACT POTENTIALS OF THE
SECOND MOST IMPORTANT VARIABLE (SLOPE)

THE ROWS ARE THE IMPACT POTENTIALS OF THE
LEAST IMPORTANT VARIABLE (LAND USE)

FM CARDS

```
CC 123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
   FM     1.     1.     2.     3.     4.
   FM     1.     2.     2.     3.     4.
   FM     2.     2.     3.     3.     4.
   FM     2.     2.     3.     3.     4.
   FM     2.     3.     3.     4.     5.
```

FINAL MATRIX

IMPACT POTENTIAL	(1) EXT.	(2) SEV.	(3) MOD.	(4) SLT.	(5) NULL
(1) EXT.	EXT.	EXT.	SEV.	MOD.	SLT.
(2) SEV.	EXT.	SEV.	SEV.	MOD.	SLT.
(3) MOD.	SEV.	SEV.	MOD.	MOD.	SLT.
(4) SLT.	SEV.	SEV.	MOD.	MOD.	SLT.
(5) NULL	SEV.	MOD.	MOD.	SLT.	NULL

THE COLUMNS ARE THE IMPACT POTENTIALS OF THE MOST IMPORTANT VARIABLE (HYDROLOGIC SOIL)

THE ROWS ARE THE COMBINED IMPACT DERIVED FROM THE INITIAL IMPACT BETWEEN VARIABLES (SLOPE) AND (LAND USE)

ANALYSIS RESULTS

FINAL IMPACT	EXT.	SEV.	MOD.	SLT.	NULL	REJ.
NUMBER OF GRID CELLS	1491.	493.	2984.	353.	0.	17.
DATA VALUE	10	7	5	3	0	-1

```
**********************************************
*                                            *
*              X   X  XXX  XXXX              *
*              XX XX X   X X   X             *
*              X X X X   X XXXX              *
*              X   X XXXXX X                 *
*              X   X X   X X                 *
*                                            *
*  XXXX   XXX   XXX  X   X  XXX   XXX  XXXXX *
*  X   X X   X X   X X  X  X   X X   X X     *
*  XXXX  X   X X     XXX   X   X X     XXX   *
*  X     XXXXX X   X X  X  XXXXX X  XX X     *
*  X     X   X  XXX  X   X X   X  XXXX XXXXX *
*                                            *
**********************************************
```

```
                         MP CARD
                         *******
CC 12345678901234567890123456789012345678901234567890123456789012345678901234567890
    MP      0       0       1       0
```

DATA VARIABLE MAPPED (NVAR) =   0

MINIMUM VALUE MAPPED (MINV) = 0

SUBLEVEL TEXT FLAG (ISUBT) = 1

LINE CARRIAGE CONTROL (LCAR) = 0

M1 OPTION(LOW AND HIGH VALUES)
****

MINIMUM FLAG = 1

MINIMUM VALUE = 0.0

MAXIMUM FLAG = 1

MAXIMUM VALUE =10.0

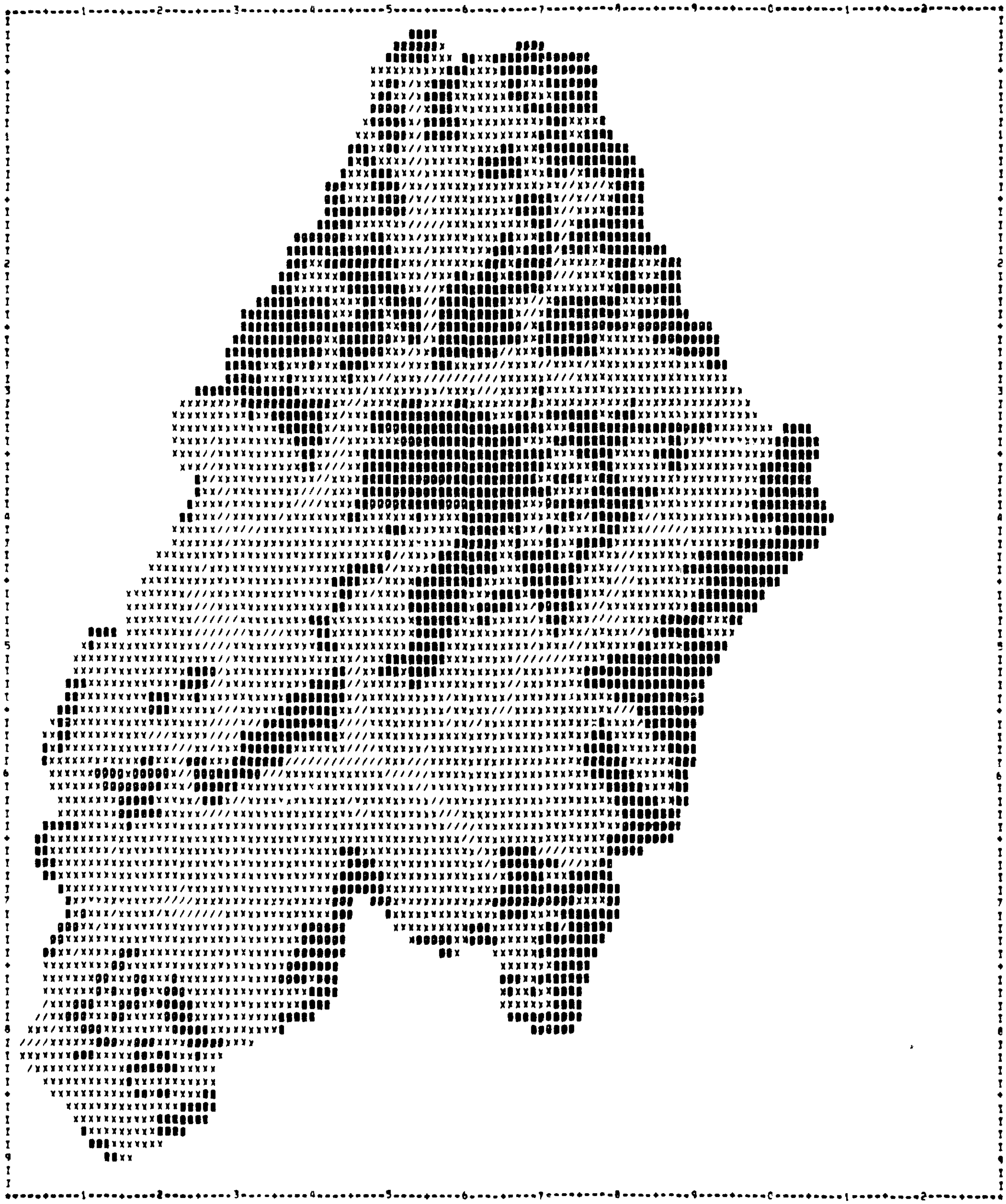


Exhibit I
43 of 76

POTENTIAL GROUND WATER POLLUTION

DATA VALUE EXTREMES ARE 0,000 10,000

LEVEL NUMBER	SYMBOL	VALUE RANGE	PERCENT VALUE RANGE	FREQUENCY	PERCENTILE RANGE	PERCENT OF AREAS	
	LLLLLLLL	0,000			0,00		
LOW	LLLLLLLL			0		0,00	
	LLLLLLLL	0,000			0,00		
	....	0,000			0,00		
1	....		10,00	0		0,00	NO POTENTIAL IMPACT
	....	1,000			0,00		
	....	1,000			0,00		
2	....		10,00	0		0,00	
	....	2,000			0,00		
	////////	2,000			0,00		
3	////////		10,00	353		6,63	SLIGHT POTENTIAL IMPACT
	////////	3,000			6,63		
	++++++++	3,000			6,63		
4	++++++++		10,00	0		0,00	
	++++++++	4,000			6,63		
	XXXXXXXX	4,000			6,63		
5	XXXXXXXX		10,00	2984		56,08	MODERATE POTENTIAL IMPACT
	XXXXXXXX	5,000			62,71		
	00000000	5,000			62,71		
6	00000000		10,00	0		0,00	
	00000000	6,000			62,71		
	@@@@@@@@	6,000			62,71		
7	@@@@@@@@		10,00	493		9,27	SEVERE POTENTIAL IMPACT
	@@@@@@@@	7,000			71,98		
	88888888	7,000			71,98		
8	88888888		10,00	0		0,00	
	88888888	8,000			71,98		
	[illegible]	8,000			71,98		
9	[illegible]		10,00	0		0,00	
	[illegible]	9,000			71,98		
	[illegible]	9,000			71,98		
10	[illegible]		10,00	1491		28,02	EXTREME POTENTIAL IMPACT
	[illegible]	10,000			100,00		
	HHHHHHHH	10,000			100,00		
HIGH	HHHHHHHH			0		0,00	
	HHHHHHHH	10,000			100,00		

TEST 5

LOCATIONAL ATTRACTIVENESS - TWO VARIABLES

Problem Statement

A rare species of ground squirrels, native only to the study area, has recently been placed on the endangered species list. The species is known to live in areas of natural vegetation typical of the region and dens only in soils in which it is extremely easy to construct burrows. At the request of an environmental group, locate the areas where this ground squirrel is most likely to be found so that protective measures may be implemented. Use the existing land use and the hydrologic soil groups data variables to perform the analysis. Use six levels of grey shade intensities to display the results.

Input Description Requirements

The usual title and job cards are required. The attractiveness analysis of an endangered species habitat location requires the set of 3 job title cards, the job specification (J) cards, the Attractiveness Package (A) cards and the Mapping Package (M) cards. Input variable NAM (J1.3 equal to one) specifies that an attractiveness analysis will be performed. An A1 card is used to specify the number of variables to be used and other control information. An A2 card is required for each variable and is used to assign a grey shade intensity value for each data variable category and to specify the relative weight of each data variable with respect to one another. The display levels are designed by specifying NLEV (M2.1 equal to six) and the corresponding value ranges (RANGE) of each level on the M3 card. The symbolism for each level is specified on the M4 cards.

Discussion of the Results

The Attractiveness map illustrates the most desirable habitat locations of the endangered ground squirrel with the more desirable the location the darker the shade. Six levels of shading are used in the analysis with the first level range being 50 percent of the absolute value and each subsequent level 10 percent. Level six has a value range of 17.9 (minimum value) to 20.0 (maximum value). An absolute value of 20 would result from a grid cell having data variable categories of existing land use and hydrologic soils groups that are assigned grey shade intensity values of 10.

```
T1                                  TEST NO.5
T2                        ATTRACTIVENESS MODELING ANALYSIS
T3                      ENDANGERED SPECIES HABITAT LOCATION
J1                              1
J2       1         1           18         92        129
J3(12F4.0,2F8.2,2F4.0,2F2.0)
A1       2                      1          HABITAT LOCATION
A2      10  010  4  2  2  1  5  1  1  5.1                              1.0EXIST LAND USE
A2       7  010  8  3  1                                               1.0HYD. SOIL GRP.
MP       0         0            1         0
M2       6
M3      50        10           10        10         10        10
M4
./X000
    +X
     A
     Z
MS
          ATTRACTIVENESS MODELING
          ENDANGERED SPECIES POTENTIAL
          HABITAT LOCATIONS
ENDT
01
01         LEAST ATTRACTIVE
06
06         MOST ATTRACTIVE
99
ME
```

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RESOURCE INFORMATION AND ANALYSIS
VERSION 1.0, SEPT.,1977

THE HYDROLOGIC ENGINEERING CENTER
U.S.ARMY CORPS OF ENGINEERS
609 SECOND ST.
DAVIS, CA. 95616

```
                                                        TEST NO.5
                                             ATTRACTIVENESS MODELING ANALYSIS
                                           ENDANGERED SPECIES HABITAT LOCATION


                        J1 CARD
                        -------
CC 1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
     J1        0         0         1         0         0


                        THIS JOB WILL PERFORM THE FOLLOWING
                        -----------------------------------

                        NUMBER OF DISTANCE DETERMINATIONS (NSRCH) =  0

                        NUMBER OF IMPACT ASSESSMENTS (NIM) =  0

                        NUMBER OF ATTRACTIVENESS MODELS (NAM) =  1

                        NUMBER OF COINCIDENTS TABULATIONS (NCOMB) =  0

                        NUMBER OF MAPS FROM THE DATA FILE (NGRPH) =  0


                        J2 CARD
                        -------
CC 1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
     J2        1         1        18        92       129         0         0


                        DATA FILE INFORMATION
                        ---------------------

                        THE COMPUTER FILE THE BASE DATA FILE IS ON (NFILE) =  1

                        THE NUMBER OF DATA VARIABLES IN THE BASE DATA FILE (NDV) = 18

                        THE NUMBER OF DATA VARIABLES IN THE WORKING DATA FILE (NN) = 18

                        THE NUMBER OF ROWS (NROWS) =  92   THE NUMBER OF COLUMNS (NCOL) = 129

                        THE WORKING DATA FILE WILL NOT BE CREATED (NSKIP) =  0

                        THE BASE DATA FILE IS FORMATTED (NFORM) =  1

                        J3 CARD
                        -------
CC 1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
     J3(12F4.0,2F8.2,2F4.0,2F2.0)
```

```
****************************************************************************************
*                                                                                      *
*   XXX  XXXXX XXXXX XXXX   XXX   XXXX XXXXX XXX X   X XXXXX X   X XXXXX  XXX   XXX    *
*  X   X   X     X   X   X X   X X       X    X  X   X X     XX  X X     X     X       *
*  X   X   X     X   XXXX  X   X X       X    X   X X  XXX   X X X XXXX   XXX   XXX    *
*  XXXXX   X     X   X  X  XXXXX X       X    X   X X  X     X  XX X         X     X   *
*  X   X   X     X   X   X X   X  XXXX   X   XXX   X   XXXXX X   X XXXXX  XXX   XXX    *
*                                                                                      *
*                            X   X  XXX  XXXX  XXXXX X                                 *
*                            XX XX X   X X   X X     X                                 *
*                            X X X X   X X   X XXXX  X                                 *
*                            X   X X   X X   X X     X                                 *
*                            X   X  XXX  XXXX  XXXXX XXXXX                             *
*                                                                                      *
****************************************************************************************
```

ATTRACTIVENESS MODEL NO. 1
FOR
HABITAT LOCATION

```
                    A1 CARD
                    -------
CC 12345678901234567890123456789012345678901234567890123456789012345678901234567890
   A1      2         0         1         HABITAT LOCATION
   A2     10 010 4 2 2 1 5 1 1 5-1 0 0 0 0 0 0 0 0 0 0 0 0 0       1.EXIST LAND USE
   A2      7 010 8 3 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0       1.HYD. SOIL GRP.


*********************************************************************************************
*                                                                                           *
*                          THE FOLLOWING DATA VARIABLES ARE IN THE MODEL                    *
*                                                                                           *
*********************************************************************************************
*   VAR  *                 RECODING FOR CLASSES                  *  INDEX  *                *
*   ID   *  0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3     *  WEIGHT *    VARIABLE    *
*   ---- *  ----------------------------------------------      *  ------ *  ------------- *
*        *                                                       *         *                *
*   10   *   010 4 2 2 1 5 1 1 5-1 0 0 0 0 0 0 0 0 0 0 0 0 0    *   1.00  *  EXIST LAND USE *
*        *                                                       *         *                *
*    7   *   010 8 3 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0    *   1.00  *  HYD. SOIL GRP. *
*********************************************************************************************

 5276. CELLS WERE EVALUATED
   62. CELLS WERE REJECTED


STATISTICAL SUMMARY OF THE INDEX AND STANDARDIZED INDEX VALUES

  INDEX TYPE          MEAN      MAXIMUM     MINIMUM     ST DEV.
 -------------       ------     -------     -------     -------

    COMPUTED          14.9       20.0         4.0         3.1

STANDARDIZED 1        50.0       90.7       -37.4        25.0

STANDARDIZED 2        68.2      100.0         0.0        19.5


** NOTE **
THE RAW COMPUTED INDEX VALUES WERE USED FOR THE MAP
```

```
***********************************************
*                                             *
*              X   X  XXX  XXXX               *
*              XX XX X   X X   X              *
*              X X X X   X XXXX               *
*              X   X XXXXX X                  *
*              X   X X   X X                  *
*                                             *
*  XXXX   XXX   XXX  X   X  XXX   XXX  XXXXX  *
*  X   X X   X X   X X  X  X   X X   X X      *
*  XXXX  X   X X     XXX   X   X X     XXX    *
*  X     XXXXX X   X X  X  XXXXX X  XX X      *
*  X     X   X  XXX  X   X X   X  XXXX XXXXX  *
*                                             *
***********************************************
```

```
                          MP CARD
                          -------
CC 1234567890123456789012345678901234567890123456789012345678901234567890123456789O
   MP      0         0         1         0
```

```
DATA VARIABLE MAPPED (NVAR) =      0

MINIMUM VALUE MAPPED (MINV) =  0

SUBLEVEL TEXT FLAG (ISUBT) =  1

LINE CARRTAGE CONTROL (LCAR) =  0
```

```
M2 OPTION(LEVELS)
-----------------

NUMBER OF MAP LEVELS =  6
```

```
M3 OPTION(DATA RANGE)
---------------------
```

MAP LEVEL	DATA RANGE
1	50.0
2	10.0
3	10.0
4	10.0
5	10.0
6	10.0

```
M4 OPTION(SYMBOLS)
------------------

                                    1                                       2
LEVEL         1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5
              - - - - - - - - - - - - - - - - - - - - - - - - -
OVERPRINT1    , / X O O O
OVERPRINT2            + /
OVERPRINT3              A
OVERPRINT4              Z
```

ATTRACTIVENESS MODELING
ENDANGERED SPECIES POTENTIAL
HABITAT LOCATIONS

DATA VALUE EXTREMES ARE 4.000 20.000

LEVEL NUMBER	SYMBOL	VALUE RANGE	PERCENT VALUE RANGE	FREQUENCY	PERCENTILE RANGE	PERCENT OF AREAS	
1	....	4.000 – 12.000	50.00	751	0.00 – 14.23	14.23	LEAST ATTRACTIVE
2	////////	12.000 – 13.600	10.00	2039	14.23 – 52.88	38.65	
3	XXXXXXXX	13.600 – 15.200	10.00	0	52.88 – 52.88	0.00	
4	00000000	15.200 – 16.800	10.00	0	52.88 – 52.88	0.00	
5	████████	16.800 – 18.400	10.00	2483	52.88 – 99.94	47.06	
6	████████	18.400 – 20.000	10.00	3	99.94 – 100.00	.06	MOST ATTRACTIVE

TEST 6

LOCATIONAL ATTRACTIVENESS - FOUR VARIABLES

Problem Statement

An industrial firm is seeking sites to construct a large manufacturing plant. To minimize construction costs the firm is seeking areas with relatively flat slopes and where relocation of existing structures would be a minimum. Other factors that will influence the selection of the plant site are the county's zoning regulation prohibiting further development in the flood plain areas and the strong desire of local residents for the plant to be located as far as possible from their homes.

The development of the locational distances from the local residences must be performed as the initial step in the analysis process. The results from the distance determinations, and data variables for slope, existing land use, flood plain delineations (damage reach boundaries) may then be used to construct an attractiveness map for determining the most desirable plant location.

Input Requirements

A distance determination must be performed prior to the construction of the attractiveness model. Since the data bank being used does not already contain the distance values, it is necessary to generate these values in the same run (requiring a distance determination package to be included and a WORKING DATA FILE to be created). The results of the distance determination will become data variable 19 and the Attractiveness results will become data variable 20 in the WORKING DATA FILE.

The key variables are NSRCH (J1.1), NAM (J1.3), NSKIP (J2.6) on the J1 Card and the NVAR (MP.1) on both MP cards

Display

Note that in the Data Bank Information output that the number of data variables in the WORKING DATA FILE is 20. This has been automatically determined by the program (whenever NSKIP = 1) as the number of data variables in the WORKING DATA BANK plus the number of Distance Determinations, Impact Assessments and Locational Attractiveness Analysis.

Both the Distance values and the Attractiveness Values are displayed' in the standard ten level, equal range symbolism. The latter map displays attractive areas as darker overprints. The flood plain area stands out as being relatively unattractive, as should be expected since flood plain areas were coded -1 (rejected) for the analysis.

```
T1                              TEST NO.6
T2   COMPLEX DISTANCE DETERMINATION AND ATTRACTIVENESS MODELING ANALYSIS
T3                    POTENTIAL INDUSTRIAL LOCATIONS
J1     1               1
J2     1       1       18      92      129       1
J3(12F4.0,2F8.2,2F4.0,2F2.0)
D1     1       2       200     333     200DISTANCE TO HOUSING
D2    10 0 0 0 1 1 1 0 0 0 0 0                                 EXISTING LAND USE
MP    19               1
MS
      DISTANCE TO HOUSING
ENDT
01
01      WITHIN ZERO TO 460 FEET
10
10      GREATER THAN 4140 FEFT
99
ME
A1     4               3       1     POTENTIAL INDUSTRIAL LOCATIONS
A2     5 0-1-1-1-1-1                                                 2.0FL'OD PLAIN
A2     8 010 9 7 5 3 2 1                                             1.0SLOPE
A2    10 0 9 5 5 3 1 9 1 110-1                                       2.0EXIST. LAND USE
A2    19 0 0 0 1 1 2 2 3 3 4 4 5 5 6 6 7 7 8 8 9 9101010             1.0DST. FRM. HSNG.
MP    20               1
MS
        ATTRACTIVENESS MODELING
        POTENTIAL INDUSTRIAL LOCATIONS
        FOUR VARIABLF ANALYSIS
ENDT
01
01      LEAST ATTRACTIVE
10
10      MOST ATTRACTIVE
99
ME
```

RIA

RESOURCE INFORMATION AND ANALYSIS
VERSION 1.0, SEPT.,1977

THE HYDROLOGIC ENGINEERING CENTER
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609 SECOND ST.
DAVIS, CA. 95616

TEST NO.6
COMPLEX DISTANCE DETERMINATION AND ATTRACTIVENESS MODELING ANALYSIS
POTENTIAL INDUSTRIAL LOCATIONS

J1 CARD

```
CC 12345678901234567890123456789012345678901234567890123456789012345678901234567890
   J1       1         0         1         0         0
```

THIS JOB WILL PERFORM THE FOLLOWING

NUMBER OF DISTANCE DETERMINATIONS (NSRCH) = 1

NUMBER OF IMPACT ASSESSMENTS (NIM) = 0

NUMBER OF ATTRACTIVENESS MODELS (NAM) = 1

NUMBER OF COINCIDENTS TABULATIONS (NCOMB) = 0

NUMBER OF MAPS FROM THE DATA FILE (NGRPH) = 0

J2 CARD

```
CC 12345678901234567890123456789012345678901234567890123456789012345678901234567890
   J2       1         1        18        92       129         1         0
```

DATA FILE INFORMATION

THE COMPUTER FILE THE BASE DATA FILE IS ON (NFILE) = 1

THE NUMBER OF DATA VARIABLES IN THE BASE DATA FILE (NDV) = 18

THE NUMBER OF DATA VARIABLES IN THE WORKING DATA FILE (NN) = 20

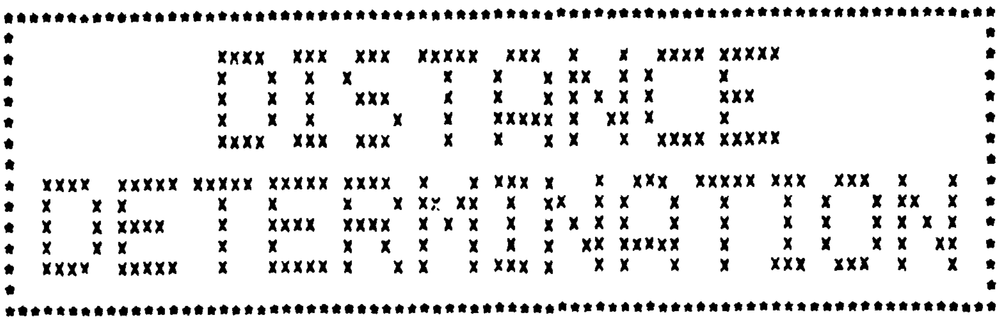
THE NUMBER OF ROWS (NROWS) = 92 THE NUMBER OF COLUMNS (NCOL) = 129

THE WORKING DATA FILE WILL BE CREATED (NSKIP) = 1

THE BASE DATA FILE IS FORMATTED (NFORM) = 1

J3 CARD

```
CC 12345678901234567890123456789012345678901234567890123456789012345678901234567890
   J3(12F4.0,2F8.2,2F4.0,2F2.0)
```



DISTANCE CALCULATION NO. 1

DISTANCE TO HOUSING

```
                  D1 CARD
                  -------

CC 1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
   D1     1       2     200.     333.     200.DISTANCE TO HOUSING

                     FOR THIS DISTANCE DETERMINATION
                  ---------------------------------

                  THE NUMBER OF DATA VARIABLES (NV) = 1

                  THE GRAPHIC OPTION (OPTG) = 2 (GRID MAP)

                  THE GRID CELL DIMENSIONS ARE
                  XLEN = 200.0      YLEN = 333.0

                  THE DISTANCE INTERVAL IS  200. FEET


                  D2 CARDS
                  --------
CC 1234567890123456789012345678901234567890123456789012345678901234567890123456789012345678901234567890
   D2     10 0 0 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0EXISTING LAND USE


**********************************************************************************************
*                       THE FOLLOWING DATA VARIABLES                                         *
*                            ARE BEING SEARCHED                                              *
**********************************************************************************************
*  VAR  *                RECODING FOR CLASSES                      *                          *
*  ID.  *   0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3        *         VARIABLE         *
*  ---- *  ------------------------------------------------        *  ----------------------  *
*       *                                                          *                          *
*  10   *   0 0 0 1 1 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0        *    EXISTING LAND USE     *
*       *                                                          *                          *
**********************************************************************************************


              A RECODING VALUE OF ONE MEANS TO ASSIGN GRID CELLS
              WITH THAT DATA CLASS A DISTANCE VALUE OF ZERO,
              AND ALL OTHER CELLS HAVE A DISTANCE VALUE ASSIGNED
              BASED ON HOW FAR AWAY IT IS FROM THE CLOSEST
              ZERO VALUED CELL.
```

```
***********************************************
*                                             *
*              X   X  XXX  XXXX               *
*              XX XX X   X X   X              *
*              X X X X   X XXXX               *
*              X   X XXXXX X                  *
*              X   X X   X X                  *
*                                             *
*  XXXX   XXX   XXX  X   X  XXX   XXX  XXXXX  *
*  X   X X   X X   X X  X  X   X X   X X      *
*  XXXX  X   X X     XXX   X   X X     XXX    *
*  X     XXXXX X   X X  X  XXXXX X  XX X      *
*  X     X   X  XXX  X   X X   X  XXXX XXXXX  *
*                                             *
***********************************************
```

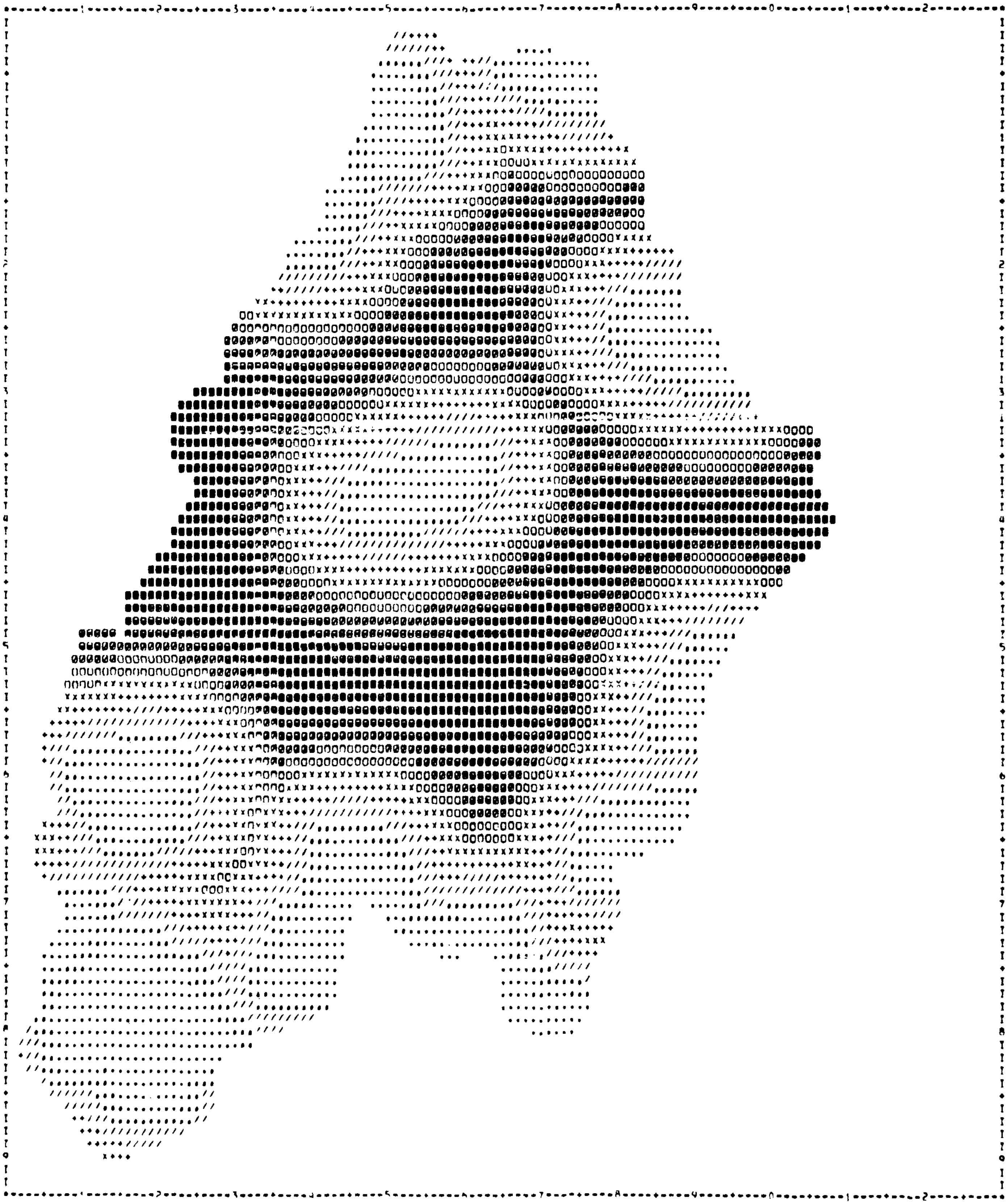
```
                      MP CARD
                      *******
CC 12345678901234567890123456789012345678901234567890123456789012345678901234567890
   MP    19        0         1         0
```

DATA VARIABLE MAPPED (NVAR) = 19

MINIMUM VALUE MAPPED (MINV) = 0

SUBLEVEL TEXT FLAG (ISUBT) = 1

LINE CARRIAGE CONTROL (LCAR) = 0



DISTANCE TO HOUSING

DATA VALUE EXTREMES ARE 0.000 23.000

LEVEL NUMBER	SYMBOL	VALUE RANGE	PERCENT VALUE RANGE	FREQUENCY	PERCENTILE RANGE	PERCENT OF AREAS	
1	....	0.000 2.300	10.00	824	0.00 15.44	15.44	WITHIN ZERO TO 460 FEET
2	•••••••• •••••••• ••••••••	2.300 4.600	10.00	582	15.44 26.34	10.90	
3	//////// //////// ////////	4.600 6.900	10.00	635	26.34 38.24	11.90	
4	++++++++ ++++++++ ++++++++	6.900 9.200	10.00	584	38.24 49.18	10.94	
5	XXXXXXXX XXXXXXXX XXXXXXXX	9.200 11.500	10.00	507	49.18 58.67	9.50	
6	OOOOOOOO OOOOOOOO OOOOOOOO	11.500 13.800	10.00	570	58.67 69.35	10.68	
7	@@@@@@@@ @@@@@@@@ @@@@@@@@	13.800 16.100	10.00	494	69.35 78.61	9.25	
8	88888888 88888888 88888888	16.100 18.400	10.00	459	78.61 87.20	8.60	
9	████████ ████████ ████████	18.400 20.700	10.00	373	87.20 94.19	6.99	
10	████████ ████████ ████████	20.700 23.000	10.00	310	94.19 100.00	5.81	GREATER THAN 4140 FEET

```
*************************************************************************************
*                                                                                   *
*  XXX  XXXXX XXXXX XXXX   XXX   XXXX XXXXX  XXX  X   X XXXXX X   X XXXXX  XXX   XXX  *
* X   X   X     X   X   X X   X X       X     X   X   X X     XX  X X     X     X     *
* X   X   X     X   XXXX  X   X X       X     X    X X  XXX   X X X XXXX   XXX   XXX  *
* XXXXX   X     X   X  X  XXXXX X       X     X    X X  X     X  XX X         X     X *
* X   X   X     X   X   X X   X  XXXX   X    XXX    X   XXXXX X   X XXXXX  XXX   XXX  *
*                                                                                   *
*                        X   X  XXX  XXXX  XXXXX X                                  *
*                        XX XX X   X X   X X     X                                  *
*                        X X X X   X X   X XXXX  X                                  *
*                        X   X X   X X   X X     X                                  *
*                        X   X  XXX  XXXX  XXXXX XXXXX                              *
*                                                                                   *
*************************************************************************************
```

ATTRACTIVENESS MODEL NO. 1
FOR
POTENTIAL INDUSTRIAL LOCATIONS

A1 CARD

```
CC 1234567890123456789012345678901234567890123456789012345678901234567890123456789O
   A1      4        0        3        1     POTENTIAL INDUSTRIAL LOCATIONS
```

A2 CARDS

```
CC 1234567890123456789012345678901234567890123456789012345678901234567890123456789O
   A2      5 0-1-1-1-1-1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0        2.FLOOD PLAIN
   A2      8 010 9 7 5 3 2 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0        1.SLOPE
   A2     10 0 9 5 5 3 1 9 1 110-1 0 0 0 0 0 0 0 0 0 0 0 0 0        2.EXIST. LAND USE
   A2     19 0 0 0 1 1 2 2 3 3 4 4 5 5 6 6 7 7 8 8 9 9101010        1.DST. FRM. HSNG.
```

THE FOLLOWING DATA VARIABLES ARE IN THE MODEL

VAR ID	RECODING FOR CLASSES 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3	INDEX WEIGHT	VARIABLE
5	0-1-1-1-1-1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	2.00	FLOOD PLAIN
8	010 9 7 5 3 2 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	1.00	SLOPE
10	0 9 5 5 3 1 9 1 110-1 0 0 0 0 0 0 0 0 0 0 0 0 0	2.00	EXIST. LAND USE
19	0 0 0 1 1 2 2 3 3 4 4 5 5 6 6 7 7 8 8 9 9101010	1.00	DST. FRM. HSNG.

3775. CELLS WERE EVALUATED
1563. CELLS WERE REJECTED

STATISTICAL SUMMARY OF THE INDEX AND STANDARDIZED INDEX VALUES

INDEX TYPE	MEAN	MAXIMUM	MINIMUM	ST DEV.
COMPUTED	27.8	39.0	7.0	6.1
STANDARDIZED 1	50.0	95.6	-34.7	25.0
STANDARDIZED 2	65.0	100.0	0.0	19.2

** NOTE **
THE STANDARDIZED 2 VALUES WERE USED FOR THE MAP

THE VALUES WERE PARTITIONED INTO INTEGER VALUES 0-10 (LEVL)=1

```
***********************************************
*                                             *
*              X   X  XXX  XXXX               *
*              XX XX X   X X   X              *
*              X X X X   X XXXX               *
*              X   X XXXXX X                  *
*              X   X X   X X                  *
*                                             *
*  XXXX   XXX   XXX  X   X  XXX   XXX  XXXXX  *
*  X   X X   X X   X X  X  X   X X   X X      *
*  XXXX  X   X X     XXX   X   X X     XXX    *
*  X     XXXXX X   X X  X  XXXXX X  XX X      *
*  X     X   X  XXX  X   X X   X  XXXX XXXXX  *
*                                             *
***********************************************
```

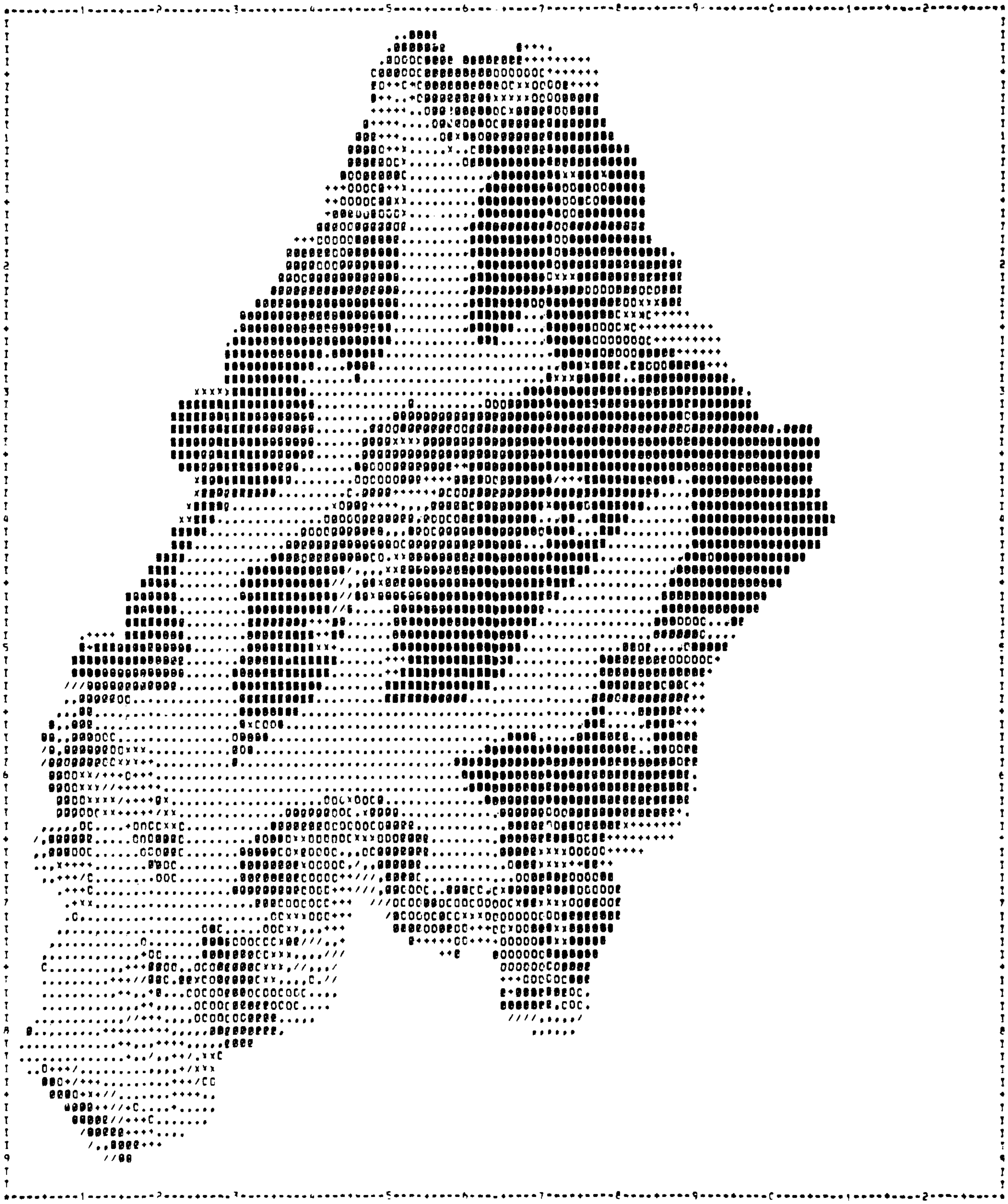
```
                    MP CARD
                    *******
CC 12345678901234567890123456789012345678901234567890123456789012345678901234567890
   MP     20         0         1         0
```

DATA VARIABLE MAPPED (NVAR) = 20

MINIMUM VALUE MAPPED (MINV) = 0

SUBLEVEL TEXT FLAG (ISUBT) = 1

LINE CARRTAGE CONTROL (LCAR) = 0



ATTRACTIVENESS MODELING
POTENTIAL INDUSTRIAL LOCATIONS
FOUR VARIABLE ANALYSIS

DATA VALUE EXTREMES ARE 0.000 10.000

LEVEL NUMBER	SYMBOL	VALUE RANGE	PERCENT VALUE RANGE	FREQUENCY	PERCENTILE RANGE	PERCENT OF AREAS	
1	....	0.000 – 1.000	10.00	1600	0.00 – 29.97	29.97	LEAST ATTRACTIVE
2	••••••••	1.000 – 2.000	10.00	132	29.97 – 32.45	2.47	
3	////////	2.000 – 3.000	10.00	67	32.45 – 33.70	1.26	
4	++++++++	3.000 – 4.000	10.00	292	33.70 – 39.17	5.47	
5	XXXXXXXX	4.000 – 5.000	10.00	136	39.17 – 41.72	2.55	
6	00000000	5.000 – 6.000	10.00	479	41.72 – 50.69	8.97	
7	88888888	6.000 – 7.000	10.00	1033	50.69 – 70.04	19.35	
8	88888888	7.000 – 8.000	10.00	763	70.04 – 84.34	14.29	
9	■■■■■■■■	8.000 – 9.000	10.00	598	84.34 – 95.54	11.20	
10	████████	9.000 – 10.000	10.00	238	95.54 – 100.00	4.46	MOST ATTRACTIVE

TEST 7

COINCIDENT TABULATION

Problem Statement

A regional planning commission is concerned about future development in the flood plain areas and wishes to determine the nature of land use conversion implied in the projected 1990 land use pattern. Construct a Coincident Tabulation of existing and 1990 land uses for each of the five damage reaches (used to indicate flood plain area) in the study area to develop the needed data.

Input Requirements

The key variables in this analysis are the identification of the grouping variable (NDAT, C2.1), the row variable (NROW, C3.1) and the column variable (NCOLI, C4.1). These values are 5 (damage reaches), 10 (existing land use), and 11 (1990 land use), respectively. The analysis is specified to be performed for cells 1.53 acres in size and generate coincident matrixes for the full range of output options (C1.1 through C1.5).

Display

Four matrixes are printed for each damage reach; the first in area units (rows and columns sum to total area in acres), the second in percentage of row value units (each row totals to 100%), the third in percentage of column value units (each column totals 100%), the fourth in total area percentage (rows and columns sum to 100%). Output for damage reach 2 is shown for illustrative purposes. Further interpretation of output is described in paragraph Coincident Tabulation.

```
T1                              TEST NO.7
T2                        COINCIDENT TABULATION
T3          EXISTING AND 1990 LAND USES WITHIN DAMAGE REACHES
J1      0       0       0       1       0       0
J2      1       1      18      92     129
J3(12F4.0,2F8.2,2F4.0,2F2.0)
CT              COINCIDENTS TEST
CT
CT          EXISTING AND 1990 LAND USES WITHIN DAMAGE REACHES
C1   1.53       0       1       1       1
C2      5       5                                              DAMAGE REACH
T2      1
T2      2
T2      3
T2      4
T2      5
C3     10      10                                              EXISTING LAND USE
T3      1NATURAL VEGETATION
T3      2DEVELOPED OPEN SPACE
T3      3LOW DENSITY HOUSING
T3      4MEDIUM DENSITY HOUSING
T3      5HIGH DENSITY HOUSING
T3      6AGRICULTURAL
T3      7INDUSTRY
T3      8COMMERCIAL
T3      9PASTURE
T3     10WATER BODIES
C4     11      10                                              1990 LAND USE
T4      1NATURAL VEGETATION
T4      2DEVELOPED OPEN SPACE
T4      3LOW DENSITY HOUSING
T4      4MEDIUM DENSITY HOUSING
T4      5HIGH DENSITY HOUSING
T4      6AGRICULTURAL
T4      7INDUSTRY
T4      8COMMERCIAL
T4      9PASTURE
T4     10WATER BODIES
```

RIA

RESOURCE INFORMATION AND ANALYSIS
VERSION 1.0, SEPT.,1977

THE HYDROLOGIC ENGINEERING CENTER
U.S.ARMY CORPS OF ENGINEERS
609 SECOND ST.
DAVIS, CA. 95616

TEST NO.7
COINCIDENT TABULATION
EXISTING AND 1990 LAND USES WITHIN DAMAGE REACHES

J1 CARD

```
CC 12345678901234567890123456789012345678901234567890123456789012345678901234567890
   J1      0       0       0       1       0
```

THIS JOB WILL PERFORM THE FOLLOWING

NUMBER OF DISTANCE DETERMINATIONS (NSRCH) = 0

NUMBER OF IMPACT ASSESSMENTS (NIM) = 0

NUMBER OF ATTRACTIVENESS MODELS (NAM) = 0

NUMBER OF COINCIDENTS TABULATIONS (NCOMB) = 1

NUMBER OF MAPS FROM THE DATA FILE (NGRPH) = 1

J2 CARD

```
CC 12345678901234567890123456789012345678901234567890123456789012345678901234567890
   J2      1       1      18      92     129       0       0
```

DATA FILE INFORMATION

THE COMPUTER FILE THE BASE DATA FILE IS ON (NFILE) = 1

THE NUMBER OF DATA VARIABLES IN THE BASE DATA FILE (NDV) = 18

THE NUMBER OF DATA VARIABLES IN THE WORKING DATA FILE (NN) = 18

THE NUMBER OF ROWS (NROWS) = 92   THE NUMBER OF COLUMNS (NCOL) = 129

THE WORKING DATA FILE WILL NOT BE CREATED (NSKIP) = 0

THE BASE DATA FILE IS FORMATTED (NFORM) = 1

J3 CARD

```
CC 12345678901234567890123456789012345678901234567890123456789012345678901234567890
   J3(12F4.0,2F8.2,2F4.0,2F2.0)
```

```
                    C1 CARD
                    -------
CC 1234567890123456789012345678901234567890123456789012345678901234567890123456789O
   C1  1.53        0        1        1        1

                    THE SIZE OF EACH GRID CELL IS  1.53 ACRES

                    ONLY SPECIFIED DATA CATEGORIES WILL BE DISPLAYED (IGTYP) =  0

                    PERCENTAGES BASED ON ROW CATEGORIES WILL BE DISPLAYED (IANLR) =  1

                    PERCENTAGES BASED ON COLUMN CATEGORIES WILL BE DISPLAYED (IANLC) =  1

                    PERCENTAGES BASED ON GROUPING CATEGORIES WILL BE DISPLAYED (IANLT) =  1

                    THE GROUPINGS ARE FOR DATA VARIABLE  5
                    AND THERE WILL BE  5 GROUPINGS

                    THE ROW CATEGORIES ARE FROM DATA VARIABLE 10
                    AND THERE WILL BE 10 CATEGORIES DISPLAYED

                    THE COLUMN CATEGORIES ARE FROM DATA VARIABLE 11
                    AND THERE WILL BE 10 CATEGORIES DISPLAYED
```

** NOTE ** Printout for Damage Reaches 1, 3, 4 and 5 are similar and not included.

COINCIDENTS TEST

EXISTING AND 1990 LAND USES WITHIN DAMAGE REACHES

DAMAGE REACH 2
COINCIDENTS MATRIX

ROW	COLUMN 1	2	3	4	5	6	7	8	9	10	ROW TOTAL
1	105.6	0.0	0.0	6.1	0.0	0.0	41.3	27.5	91.8	0.0	272.3
3	0.0	0.0	0.0	3.1	0.0	0.0	0.0	0.0	0.0	0.0	3.1
6	6.1	0.0	0.0	0.0	0.0	0.0	6.1	0.0	7.7	0.0	19.9
7	4.6	0.0	0.0	0.0	0.0	0.0	13.8	0.0	4.6	0.0	23.0
9	24.5	0.0	0.0	1.5	0.0	0.0	10.7	9.2	24.5	0.0	70.4
TOTAL	140.8	0.0	0.0	10.7	0.0	0.0	71.9	36.7	128.5	0.0	388.6

ROW CATEGORIES ARE EXISTING LAND USE

1 NATURAL VEGETATION
2 DEVELOPED OPEN SPACE
3 LOW DENSITY HOUSING
4 MEDIUM DENSITY HOUSING
5 HIGH DENSITY HOUSING
6 AGRICULTURAL
7 INDUSTRY
8 COMMERCIAL
9 PASTURE
10 WATER BODIES

COLUMN CATEGORIES ARE 1990 LAND USE

1 NATURAL VEGETATION
2 DEVELOPED OPEN SPACE
3 LOW DENSITY HOUSING
4 MEDIUM DENSITY HOUSING
5 HIGH DENSITY HOUSING
6 AGRICULTURAL
7 INDUSTRY
8 COMMERCIAL
9 PASTURE
10 WATER BODIES

** NOTE ** AREA UNITS

COINCIDENTS TEST

EXISTING AND 1990 LAND USES WITHIN DAMAGE REACHES

DAMAGE REACH 2
COINCIDENTS MATRIX

ROW	COLUMN 1	2	3	4	5	6	7	8	9	10	ROW TOTAL
1	38.8	0.0	0.0	2.2	0.0	0.0	15.2	10.1	33.7	0.0	100.0
3	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
6	30.8	0.0	0.0	0.0	0.0	0.0	30.8	0.0	38.5	0.0	100.0
7	20.0	0.0	0.0	0.0	0.0	0.0	60.0	0.0	20.0	0.0	100.0
9	34.8	0.0	0.0	2.2	0.0	0.0	15.2	13.0	34.8	0.0	100.0
TOTAL	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

ROW CATEGORIES ARE EXISTING LAND USE

1 NATURAL VEGETATION
2 DEVELOPED OPEN SPACE
3 LOW DENSITY HOUSING
4 MEDIUM DENSITY HOUSING
5 HIGH DENSITY HOUSING
6 AGRICULTURAL
7 INDUSTRY
8 COMMERCIAL
9 PASTURE
10 WATER BODIES

COLUMN CATEGORIES ARE 1990 LAND USE

1 NATURAL VEGETATION
2 DEVELOPED OPEN SPACE
3 LOW DENSITY HOUSING
4 MEDIUM DENSITY HOUSING
5 HIGH DENSITY HOUSING
6 AGRICULTURAL
7 INDUSTRY
8 COMMERCIAL
9 PASTURE
10 WATER BODIES

** NOTE ** PERCENTAGE OF ROW CATEGORIES

COINCIDENTS TEST

EXISTING AND 1990 LAND USES WITHIN DAMAGE REACHES

DAMAGE REACH 2
COINCIDENTS MATRIX

ROW	COLUMN 1	2	3	4	5	6	7	8	9	10	ROW TOTAL
1	75.0	0.0	0.0	57.1	0.0	0.0	57.4	75.0	71.4	0.0	0.0
3	0.0	0.0	0.0	28.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6	4.3	0.0	0.0	0.0	0.0	0.0	8.5	0.0	[illegible]	0.0	0.0
7	3.3	0.0	0.0	0.0	0.0	0.0	19.1	0.0	3.6	0.0	0.0
9	17.4	0.0	0.0	14.3	0.0	0.0	14.9	25.0	19.0	0.0	0.0
TOTAL	100.0	0.0	0.0	100.0	0.0	0.0	100.0	100.0	100.0	0.0	0.0

ROW CATEGORIES ARE EXISTING LAND USE

1 NATURAL VEGETATION
2 DEVELOPED OPEN SPACE
3 LOW DENSITY HOUSING
4 MEDIUM DENSITY HOUSING
5 HIGH DENSITY HOUSING
6 AGRICULTURAL
7 INDUSTRY
8 COMMERCIAL
9 PASTURE
10 WATER BODIES

COLUMN CATEGORIES ARE 1990 LAND USE

1 NATURAL VEGETATION
2 DEVELOPED OPEN SPACE
3 LOW DENSITY HOUSING
4 MEDIUM DENSITY HOUSING
5 HIGH DENSITY HOUSING
6 AGRICULTURAL
7 INDUSTRY
8 COMMERCIAL
9 PASTURE
10 WATER BODIES

** NOTE ** PERCENTAGE OF COLUMN CATEGORIES

COINCIDENTS TEST

EXISTING AND 1990 LAND USES WITHIN DAMAGE REACHES

DAMAGE REACH 2
COINCIDENTS MATRIX

ROW	COLUMN 1	2	3	4	5	6	7	8	9	10	ROW TOTAL
1	27.2	0.0	0.0	1.6	0.0	0.0	10.6	7.1	23.6	0.0	70.1
3	0.0	0.0	0.0	.8	0.0	0.0	0.0	0.0	0.0	0.0	.8
6	1.6	0.0	0.0	0.0	0.0	0.0	1.6	0.0	2.0	0.0	5.1
7	1.2	0.0	0.0	0.0	0.0	0.0	3.5	0.0	1.2	0.0	5.9
9	6.3	0.0	0.0	.4	0.0	0.0	2.8	2.4	6.3	0.0	18.1
TOTAL	36.2	0.0	0.0	2.8	0.0	0.0	18.5	9.4	33.1	0.0	100.0

ROW CATEGORIES ARE EXISTING LAND USE

1 NATURAL VEGETATION
2 DEVELOPED OPEN SPACE
3 LOW DENSITY HOUSING
4 MEDIUM DENSITY HOUSING
5 HIGH DENSITY HOUSING
6 AGRICULTURAL
7 INDUSTRY
8 COMMERCIAL
9 PASTURE
10 WATER BODIES

COLUMN CATEGORIES ARE 1990 LAND USE

1 NATURAL VEGETATION
2 DEVELOPED OPEN SPACE
3 LOW DENSITY HOUSING
4 MEDIUM DENSITY HOUSING
5 HIGH DENSITY HOUSING
6 AGRICULTURAL
7 INDUSTRY
8 COMMERCIAL
9 PASTURE
10 WATER BODIES

** NOTE ** PERCENTAGE OF TOTAL AREA

EXHIBIT II
INPUT DESCRIPTION
RESOURCE INFORMATION AND ANALYSIS

This exhibit contains a detailed description of input data requirements, data coding instructions and a general overview of the input cards required to perform specific tasks. Table II-1 shows the sequential arrangement of cards. Figure II-1 displays the data card stream.

The detailed data coding description is presented by analysis function and card, with the function of each card discussed and the specific input variables described. Variable locations for each input card are shown by field number. Each card is divided into ten fields of eight card columns each, except field 1, and as otherwise noted throughout the input description for a few special data sets. Variables occurring in field 1 may only occupy card columns 3 - 8 since card columns 1 and 2 (called field 0) are reserved for required card identification characters. Data variables are used to indicate whether a program option is to be used or not, such as by specifying the numbers -1, 0, 1, or to express a specific variable magnitude. For the latter, a + sign is shown in the description under "value" and the numeric value of the variable should be entered as input. When the variable value is equal to zero the variable may be left blank. If decimal points are not punched for a variable, the number must be right justified in the field. Any number without a sign is considered positive. The referencing notation (card field) is used to refer to specific fields of cards, e.g., J1.3 refers to the third field of the J1 card.

Unless noted otherwise, variable names beginning with the letters I, J, K, L, M or N represent integer variables and a decimal point must not appear in the field. All others are floating point variables and may either have a decimal point or be right justified.

The cards are listed in sequence for each optional operation that may be performed. The optional operation card groupings may be sequenced such that the results from one analysis can be used in the performance of other operations as desired.

TABLE II-1

SUMMARY OF INPUT CARDS

A summary of the type of information contained on each card and the page number describing the input variables required for each card are as follows:

Cards	Description of Card Type	Page
A. TITLE CARDS - Required		5
T1, T2, T3	Title cards for the entire job	5
B. JOB CARDS - Required		5
J1	Specifies type of analysis(es) to be performed	5
J2	BASE DATA FILE specifications	6
J3	Optional - BASE DATA FILE format	7
C. DISTANCE DETERMINATION PACKAGE		8
D1	Specific job requirements	9
D2	BASE DATA FILE variable specifications	10
D. IMPACT ASSESSMENTS PACKAGE		11
IT	Title cards	12
I1	Specific job requirements	12
I2	BASE DATA FILE variable specifications	13
IM FM	Optional - impact matrix value assignment	15
E. LOCATIONAL ATTRACTIVENESS PACKAGE		17
A1	Specific job requirements	18
A2	BASE DATA FILE variable specifications	19

A. T Cards

Required. Three title cards, T1, T2, and T3 are required for output labeling. The T2 and T3 cards have the same format as the T1 card shown below except Field 0 must be T2 and T3, respectively.

Field	Variable	Value	Description
0	CHCK	T1	Card identification.
1-10	Title	AN	Alphanumeric job title information, preferably centered in columns 2-80, inclusive on each card.

B. J Cards

Required. The J1 and J2 cards are required for specification of program operations and BASE DATA FILE features required to perform the overall job. The J3 card is required if the BASE DATA FILE is formatted.

J1 Card

Required. The J1 card describes the number and types of analyses to be performed. The analysis packages are executed in the order prescribed on this card.

Field	Variable	Value	Description
0	CHCK	J1	Card identification.
1	NSRCH	+	Number of Distance Determinations to be performed.
2	NIM	+	Number of Impact Assessments to be performed.
3	NAM	+	Number of Locational Attractiveness analyses to be performed.
4	NCOMB	+	Number of Coincidents Tabulations to be performed.
5	NGRPH	+	Number of variables from BASE DATA FILE to be mapped. Mapping Package cards must follow the last analysis package, or the J cards if no analysis is to be done.

J2 Card

Required. The J2 card describes the contents and structure of the BASE DATA FILE. If the BASE DATA FILE is on disc or tape, NFILE (J2.1) must equal 1. If the BASE DATA FILE is on cards (J2.1 equals 5), a WORKING DATA FILE must be generated (NSKIP (J1.6 must equal 1).

Field	Variable	Value	Description
0	CHCK	J2	Card identification.
1	NFILE	1	The BASE DATA FILE is stored on computer system file 1 (disc or tape).
		5	The BASE DATA FILE is stored on cards. For this condition a WORKING DATA FILE must be generated (NSKIP (J2.6) must equal 1).
2	NFORM	0	The BASE DATA FILE is unformatted; a J3 card is not required.
		1	The BASE DATA FILE is formatted; a J3 card must follow the J2 card.
3	NDV	+	Number of spatial data variables contained in the BASE DATA FILE.
4	NROWS	+	Number of rows in the BASE DATA FILE.
5	NCOL	+	Number of columns in the BASE DATA FILE.
6	NSKIP	0	No WORKING DATA FILE will be created.
		1	A WORKING DATA FILE will be created and may be used to store results for use in subsequent evaluations in this job or future jobs.
7	ISAVE	0	The WORKING DATA FILE will not be saved.
		1	The WORKING DATA FILE will be saved and will become the new BASE DATA FILE. NSKIP must be 1. The user must provide the necessary control cards to save file 20, the temporary computer system location of the new BASE DATA FILE.

J3 Card

Required if NFORM (J2.2) is equal to 1. The J3 card describes the format structure of the BASE DATA FILE.

Field	Variable	Value	Description
0	CHCK	J3	Card identification.
		(	There must be a left parenthesis, (, in card column 3.
1-10		AN	Description of the format (example, 10F2.0, 2X, 2F8.6). All data variable fields must be in an F (fixed point) format.
		)	There must be a right parenthesis ending the format.

DISTANCE DETERMINATION PACKAGE

C. D Cards - Distance Determination Package. Required if NSRCH (J1.1) is greater than zero.

The D cards describe the program operation procedures and features of each data variable subjected to distance analysis. There must be NSRCH (J1.1) sets of D cards. If a graphic map of the results is desired, (OPTG (D1.2) is equal to 2), the Mapping Package cards must be included following each group of D cards.

The results from each distance determination will be placed in the BASE DATA FILE if the WORKING DATA FILE is created (J1.6 equals 1). If the results are placed in the WORKING DATA FILE, they are available as an additional input variable into any of the subsequent Distance Determination, Impact Analyses, Attractiveness Modeling or Coincident Tabulation analyses.

D1 Card

Required. The D1 card describes program operation procedures and the dimensions of the grid cells.

Field	Variable	Value	Description
0	CHCK	D1	Card identification.
1	NV	+	Number of data variables that will be included in this Distance Determination.
2	OPTG	0	No graphics of results.
		1	Numeric (distance) map of results.
		2	Overprinted grey-shaded map of the results. Mapping Package (M Cards) required following D cards.
3	XLEN	+	Horizontal dimension (X-direction) in feet of BASE DATA FILE grid cell.
4	YLEN	+	Vertical dimension (y direction) in feet of BASE DATA FILE grid cell.
5	DINV	+	Radius (in feet) for grid cell value assignments. Example, if DINV = 200 all cells within 200 feet radius are assigned the same distance value. Grid cells between 200 and 400 feet radii are assigned the same distance value, etc.
6-10	TITLE	AN	Description of the Distance Determination to be performed for output labeling.

D2 Card. Required.

NV (D1.1) D2 cards required. The D2 card is used to specify the classes or categories of each data variable from which the distance determinations are to be computed.

Field	Variable	Value	Description
0	CHCK	D2	Card identification.
1	NVAR	+	Sequence number of the data variable in the data file being accessed (BASE or WORKING DATA FILE).

2-7 IRC(I) The following fields (2-7) are divided into 24 two-card column subfields. The recoding indicated by a 1 in the appropriate subfield identifies the class of the data variable for which the distance determination will be made.

Subfield			
1	IRC(1)	0	No distance determination will be made for grid cells assigned to this category.
		1	The distance of each grid cell to the nearest grid cell assigned to this category will be determined.
			Subfield 1 corresponds to category 0 for this data variable, subfield 2 for category 1 etc.
2	IRC(2)	0,1	Etc., for 24 subfields.

Field			
8-10	VN	AN	Name of data variable for output labeling.

The Mapping Package (M cards) must be inserted after each set of Distance Determination cards if printer maps are required.

IMPACT ASSESSMENT PACKAGE

D. I Cards - Impact Assessment

Required if NIM (J1.2) is greater than zero. There must be a complete set of I cards for each impact assessment requested. The I cards include three title cards (IT), an I1 card describing the basic analysis parameters, an I2 card for each data variable used in the analysis (either 2 or 3 variables may be used), and the option of inputting the user's desired potential impact matrices on the IM and/or the FM cards. For graphic output, map cards (M) must follow each set of I cards.

IT Card

Three IT cards are required for output labeling which will appear on the first page of output from each impact assessment.

Field	Variable	Value	Description
0	CHCK	IT	Card identification.
1-10	TITLE	AN	Title identification.

I1 Card

Required. The I1 card defines the information and analysis procedures to be used to perform the impact evaluations. The user has the option of specifying the impact matrices format or selecting one of the four standard impact matrix format options. The standard options are described in Program Description.

Field	Variable	Value	Description
0	CHCK	I1	Card identification.
1	NVAR	2,3	Number of variables to be used in impact analysis. For two variable analysis set I1.2 equal to -1 and specify final impact matrix in I1.3.
2	MATX1	-1	Two variable analysis. Must be -1 if NVAR I1.1 is equal to 2.
		0	User specified impact matrix (IM cards must be provided).
		1	Use Standard 1 for the initial impact matrix.
		2	Use Standard 2 for the initial impact matrix.

		3	Use Standard 3 for the initial impact matrix.
		4	Use Standard 4 for the initial impact matrix.
3	MATX2	0	User specified impact matrix (FM cards must be included).
		1	Use Standard 1 for the final impact matrix.
		2	Use Standard 2 for the final impact matrix.
		3	Use Standard 3 for the final impact matrix.
		4	Use Standard 4 for the final impact matrix.

I2 Card

NVAR (I1.1) I2 cards required. Defines data variable character and impact potential.

Field	Variable	Value	Description
0	CHCK	I2	Card identification.
1	NIMP	1	This data variable is the most important in the analysis.
		2	This data variable is the second most important in the analysis.
		3	This data variable is the least important in the analysis.
2	NVARDB	+	Sequence number of the data variable in the file being accessed (BASE or WORKING DATA FILE).

3-8 RECODE (I) The following fields (3-8) are divided into 24 two card column subfields. The recoding indicated by the numeric value identifies the impact character of each class of the data variable.

Subfield			
1	RECODE(1)	1	This category has EXTREME impact potential.
		2	This category has SEVERE impact potential.
		3	This category has MODERATE impact potential.
		4	This category has SLIGHT impact potential.
		5	This category has NULL impact potential.

Subfield 1 corresponds to category 0 for this data variable, subfield 2 for category 1, etc.

2	RECODE(2)	1,	Etc., for 24 subfields.

Field	Variable	Value	
9-10	VARTIT	AN	Data variable description for output labeling.

IM Cards

Five IM cards are required if MATX1 (I1.2) is equal to zero and NVAR (I1.1) is 3 with each card representing each initial impact matrix row. The first IM card is for the top (EXTREME) row of the matrix, with each subsequent IM card representing the SEVERE, MODERATE, SLIGHT, and NULL rows, respectively. If NVAR (I1.1) is equal to 3, the initial matrix is constructed to determine the potential impact between the second and third most important data variables, with the results used to determine the final matrix (FM cards).

Field	Variable	Value	Description
0	CHCK	IM	Card identification.
1	TAB1(1,X)	+	Impact potential between the X row and the EXTREME column of the second most important variable. Recoded as 1, 2, 3, 4 or 5.*
2	TAB1(2,X)	+	Impact potential between the X row and the SEVERE column of the second most important variable. Recoded as 1, 2, 3, 4 or 5.*
3	TAB1(3,X)	+	Impact potential between the X row and the MODERATE column of the second most important variable. Recoded as 1, 2, 3, 4 or 5.*
4	TAB1(4,X)	+	Impact potential between the X row and the SLIGHT column of the second most important variable. Recoded as 1, 2, 3, 4 or 5.*
5	TAB1(5,X)	+	Impact potential between the X row and the NULL column of the second most important variable. Recoded as 1, 2, 3, 4 or 5.*

* A recode value of 1 for Extreme, 2 for Severe, 3 for Moderate, 4 for Slight and 5 for Null.

FM Cards

Five FM cards required if MATX2 (I1.3) is equal to zero representing each row in the final impact matrix.

Field	Variable	Value	Description
0	CHCK	FM	Card identification.
1	TAB2(1,X)	+	Impact potential between the X row and the EXTREME column of the most important variable. Recoded as 1, 2, 3, 4 or 5.*
2	TAB2(2,X)	+	Impact potential between the X row and the SEVERE column of the most important variable. Recoded as 1, 2, 3, 4 or 5.*
3	TAB2(3,X)	+	Impact potential between the X row and the MODERATE column of the most important variable. Recoded as 1, 2, 3, 4 or 5.*
4	TAB2(4,X)	+	Impact potential between the X row and the SLIGHT column of the most important variable. Recoded as 1, 2, 3, 4 or 5.*
5	TAB2(5,X)	+	Impact potential between the X row and the NULL column of the most important variable. Recoded as 1, 2, 3, 4 or 5.*

The Mapping Package (M Cards) are mandatory and must be inserted after each set of Impact Assessment (I) cards.

* A recode value of 1 for Extreme, 2 for Severe, 3 for Moderate, 4 for Slight and 5 for Null.

ATTRACTIVENESS MODELING PACKAGE

E. A Cards (Locational Attractiveness Package)

Required if NAM (J1.3) is greater than zero. There must be a complete set of A cards for each Relative Attractiveness analysis specified. The Attractiveness Package consists of an A1 card which provides the basic analysis parameters, an A2 card for each data variable in the analysis followed by the appropriate Mapping Package (M cards) to display the results. The results may be stored in the WORKING DATA FILE for additional analysis in this job or for future evaluations.

A1 Card

Required. The A1 card defines the number of data variables and display options to be used.

Field	Variable	Value	Description
0	CHCK	A1	Card identification.
1	NV	+	Number of data variables to be used in the relative attractiveness computation.
2			Reserved for future use.
3	INDX	1	Raw computed index values will be displayed and available to be stored in the WORKING DATA FILE.
		2	Standardized I* index values will be displayed and available to be stored in the WORKING DATA FILE.
		3	Standardized II* index values will be displayed and available to be stored in the WORKING DATA FILE.
4	LEVL	0	No level breakdown.
		1	Partition the Standardized II values into ten equal ranged levels, one through ten. Rejected values and the lowest valued cells will be set to a value of zero.
5-10	MV	AN	Title for the relative attractiveness computation for output labeling.

* See II. DESCRIPTION OF PROGRAM, page 19, for an explanation of Standardized I and Standardized II indexing.

A2 Card

Required. There must be NV (A1.1) number of A2 cards (one for each data variable used in the analysis). The A2 card describes the relative attractiveness of each class of the data with respect to the Attractiveness model.

Field	Variable	Value	Description
0	CHCK	A2	Card identification.
1	IVAR	+	Sequence number of the data variable in the data file being accessed (BASE or WORKING DATA FILE).

2-7 IRC(I) The following fields (2-7) are divided into 24-two card column subfields. The recoding indicated by the numeric value identifies the attractiveness character of each class of the data value.

Subfield			
1	IRC(I)	-1	Reject any grid cells which have this class from the analysis.
		0	Grid cells in this category will be given no additional weight.
		1-9	Grid cells in this category will be given the value indicated in determining relative attractiveness.
		10	Grid cells in this category will be given maximum weight.

Subfield 1 corresponds to category 0 for this data variable, subfield 2 for category 1, etc. See worksheet EXHIBIT III.

Field	Variable	Value	Description
8	CONST	+	Relative importance or weight of this spatial data variable with respect to other data variables in the relative attractiveness model.
9-10	VN	AN	Name of the spatial data variable.

The Mapping Package (M cards) are mandatory and must be inserted after each set of Attractiveness Modeling (A) cards.

COINCIDENT TABULATION PACKAGE

F. C Cards (Coincident Tabulation)

Required if NCOMB (J1.4) is greater than zero. There must be a complete set of C and T cards for each Coincident Tabulation analysis requested. The C and T cards describe the variables to be included and the grouping of the variables for analysis.

CT Cards

Required. Three title cards are required for the job output labeling. The title written on the CT cards appears at the top of each page of output.

Field	Variable	Value	Description
0	CHCK	CT	Card identification.
1-10	TITLE	AN	Title information.

C1 Card

Required.

Field	Variable	Value	Description
0	CHCK	C1	Card identification.
1	SIZE	+	Grid cell size in acres.
2	IGTYP	0	Data categories not specified will not be grouped.
		1	Data categories not specified will be grouped.
3	IANLR	0	Additional output in terms of percentages derived by row will not be displayed.
		1	Additional output in terms of percentages derived by row will be displayed.
4	IANLC	0	Additional output in terms of percentages derived by column will not be displayed.
		1	Additional output in terms of percentages derived by column will be displayed.
5	IANLT	0	Additional output in terms of percentages of the total grouping area will not be displayed.
		1	Additional output in terms of percentages of the total grouping area will be displayed.

C2 Card

Required. (The C2 card defines the data variable that will form the grouping categories for the coincidents tabulation - watershed, damage reach boundaries, census tracts, etc.).

Field	Variable	Value	Description
0	CHCK	C2	Card identification.
1	NDAT	+	Sequence number of data variable for coincident grouping.
2	NCLAS	+	The number of data categories of the data variable (NDAT) (max. of 30) that will require coincident tabulation output.
3-7			Reserved for future use.
8-10	GTIT	AN	Grouping title.

T2 Card

Required. There must be NCLAS (C2.2) T2 cards, one for each grouping category.

Field	Variable	Value	Description
0	CHCK	T2	Card identification.
1	NCLASY	+	Class or category identification that is grouped.

C3 Card

Required. The C3 card defines the data variable corresponding to the row values in the coincidents matrix.

Field	Variable	Value	Description
0	CHCK	C3	Card identification
1	NROW	+	Sequence number of the data variable of the row category in the coincidents matrix.
2	NROWK	+	Number of categories to be displayed in this data variable (maximum of 25).
3-7			Reserved for future use.
8-10	RTIT	AN	Title for this data variable.

T3 Card

Required. NROWK T3 cards are required in sequential order (top to bottom) for each row data variable category.

Field	Variable	Value	Description
0	CHCK	T3	Card identification.
1	NROWY	+	Class or category.
2-5	TIT11	AN	Category title.

C4 Card

Required. The C4 card describes the data variable corresponding to the column categories of the coincidents matrix.

Field	Variable	Value	Description
0		C4	Card identification.
1	NCOL1	+	The sequence number of the data variable of the column categories in the coincidents matrix.
2	NCOLK	+	The number of categories to be displayed in this data variable. (Maximum of 30).
3-7			Reserved for future use.
8-10	CTIT	AN	Title of this data variable.

T4 Card

Required. NCOLK T3 cards are required in sequential order (left to right) representing each column data variable category.

Field	Variable	Value	Description
0	CHCK	T4	Card identification.
1	NCØLY	+	Class or category.
2-5	TIT12	AN	Category title.

MAPPING PACKAGE

M Cards (Mapping Package)

The Mapping Package is required to display analysis results and to display data variables in the BASE or WORKING DATA FILE (NGRPH (J1.5) is greater than zero). Analysis display requires the Mapping Package cards to be inserted immediately after the appropriate analysis cards. Data variable displays requires the Mapping Package cards to be inserted after all analysis have been finished. The display format and symbolism may be selected by the user.

MP Card

Required. Data variable to be displayed and the relative mapping scale.

Field	Variable	Value	Description
0	CHCK	MP	Card identification.
1	NVAR	0	Analysis result will be mapped and a WORKING DATA FILE has not been created.
		+	Sequence number of the data variable to be displayed. If a map is to be made directly from a formatted BASE DATA FILE, a WORKING DATA FILE must have been created (J2.6 = 1).
2	MINV	+/-	The minimum absolute value to be displayed If left blank a minimum value of zero (0) is assumed. Cells that have values below MINV will not be plotted, i.e. will be left blank.
3	ISUBT	0	No sublevel text to be provided.
		1	Sublevel text will be provided for mapping symbols.
4	LCAR	0	Line printer advances before checking for overprint control.
		1	Line printer checks for overprint control before advancing.

M1 Card

Optional. The M1 card may be used to specify the value range for mapping.

Field	Variable	Value	Description
0	IOPT	M1	Card identification.
1	OPT(4)	0	No lower level value is specified.
		1	Low level value is specified in M1.2.

2	VALMIN	-/0/+	Lowest data value that will be displayed. All values between this value and the minimum display value (MINV (MP.2)) will be displayed as L's with the default symbolism.
3	OPT(5)	0	No high level value is specified.
		1	High level value is specified in M1.4.
4	VALMAX	-/0/+	Highest data value that will be displayed. All values above this level will be displayed as H's with the default symbolism.

M2 Card

Optional. Required if the number of levels or class intervals of the total value range is to be subdivided (less than or equal to 20 intervals). If the M2 card is not used, the program defaults to a standard option of 10 intervals.

Field	Variable	Value	Description
0	IOPT	M2	Card identification.
1	NLEV	+	Number of levels (class intervals) that the output data will be grouped into graphical displays. Less than or equal to 20.

M3 Card

Optional. The M3 card specifies the range for each of the levels specified on the M2 card or for the default of 10 levels. The exclusion of the M3 cards (default) would designate each level to be assigned an equal value range.

Field	Variable	Value	Description
0	IOPT	M3	Card identification.
1	RANGE(1)	+	The proportionate size of level 1 (percent or absolute value).
2	RANGE(2)	+	The proportionate size of level 2.
NLEV	RANGE(NLEV)	+	The proportionate size of level 3, etc., up to level NLEV. If more than 10 levels are specified, a second M3 card is required.

M4 Cards

Optional. The M4 cards provide the user with the option of designating the overprint characters used as the grey-shade symbolism for the output display of each classification level. A total of 5 M4 cards are required if this option is used. If the M4 cards are not included, the program defaults to the standard symbolism.

1st M4 Card

Field	Variable	Value	Description
0	IOPT	M4	Card identification that designates that four overprint character cards follow.

2nd M4 Card

Required. The alphanumeric values (M4) used as card identification in card columns 1 and 2 are omitted. Note card columns are used, not fields.

Card Column	Variable	Value	Description
1	SYMBOL	AN	First overprint character for level (class interval) 1.
2-20	SYMBOL	AN	First overprint character for level (class interval) 2, etc., up to 20 levels.
21	SYMBOL	AN	First overprint character for "low" level.
23	SYMBOL	AN	First overprint character for "high" level.

3rd M4 Card

Required. Designates symbols for graphic displays. The alphanumeric (M4) values used for card identification in card columns 1 and 2 are omitted. Note card columns are used, not fields.

Card Column	Variable	Value	Description
1	SYMBØL	AN	Second overprint character for level (class interval) 1.
2-20	SYMBØL	AN	Second overprint character for level (class interval) 2, etc., up to 20 levels.
21	SYMBØL	AN	Second overprint character for "low" level.
23	SYMBØL	AN	Second overprint character for "high" level.

4th M4 Card

Required. Designates symbols for graphic displays. The alphanumeric (M4) values used for card identification in columns 1 and 2 are omitted. Note card columns are used, not fields.

Card Column	Variable	Value	Description
1-20	SYMBOL	AN	Third overprint character for level (class interval) 1, etc., up to 20 levels.
21	SYMBOL	AN	Third overprint character for "low" level.
23	SYMBOL	AN	Third overprint character for "high" level.

5th M4 Card

Required. Designates symbols for graphic displays. The alphanumeric values (M4) used for card identification in columns 1 and 2 are omitted. Note card columns are used, not fields.

Card Column	Variable	Value	Description
1-20	SYMBOL	AN	Fourth overprint character for level (class interval) 1, etc., up to 20 levels.
21	SYMBOL	AN	Fourth overprint character for "low" level.
23	SYMBOL	AN	Fourth overprint character for "high" level.

M5 Card

Optional. The M5 card specifies the size of the grid cell mapping character. The exclusion of the M5 card (default) would designate one printer character to represent the grid cell mapping character.

Field	Variable	Value	Description
0	IOPT	M5	Card identification.
1	NGD	+	The number of characters to be printed downwards in the y-direction for each grid cell.
2	NGA	-	The number of characters to be printed across in the x-direction for each grid cell.

M6 Cards

Optional. The M6 cards provide the user with the option of designating a specific map level for a data variable value. These cards provide the opportunity to group non-sequential data variable values into the same mapping level.

1st M6 Card

Required. Specifies the number of data variable values that will be grouped into graphical display levels. There must be one pair for every possible value.

Field	Variable	Value	Description
0	IOPT	M6	Card identification.
1	NGRIDV	+	The number of (value, level) pairs to follow on additional M6 cards (5 pairs per card).

2nd M6 Card

Required. Designates the data variable values associated with the various mapping levels.

Field	Variable	Value	Description
0	IOPT	M6	Card identification.
1	GRDVAL	+	1st data variable value.
2	GRDLEV	+	Map level to include 1st value.
3	GRDVAL	+	2nd data variable value.
4	GRDLEV	+	Map level to include 2nd value.
.			
.			
.			
9	GRDVAL	+	5th data variable value.
10	GRDLEV	+	Map level to include 5th value.

3rd - Nth M6 Cards

Optional. Required if NGRIDV (M6.1) is greater than 5.

Field	Variable	Value	Description
0	IOPT	M6	Card identification.
1	GRDVAL	+	6th data variable value.
2	GRDLEV	+	Map level to include 6th value.
⋮			
N-1	GRDVAL	+	Nth data variable value.
N	GRDLEV	+	Map level to include Nth value.

MS Card

Required. Flag card for termination of map input.

Field	Variable	Value	Description
0	IOPT	MS	Specifies optional Mapping Package is complete and causes map execution.

Text Cards

Optional. Any number of additional text cards may be included. All fields and card columns may be used.

Field	Variable	Value	Description
0-10	STXT	AN	Optional descriptive text to be printed below map.

ENDT Card

Required. Signals end of optional text input.

Card Column	Variable	Value	Description
1-4	ICHK	ENDT	Specifies end of text card stream.

Sublevel Text Cards

Optional. Required if ISUBT (MP.3) is greater than zero. Sublevel text cards will be printed adjacent to output symbolism below overprint map. Normally used to legend symbolism. May supply up to 3 text cards for each display level.

Card Column	Variable	Value	Description
1-2	NUMS	+	Class interval (level).
9-80	STXT	AN	Sublevel text.

99 Card

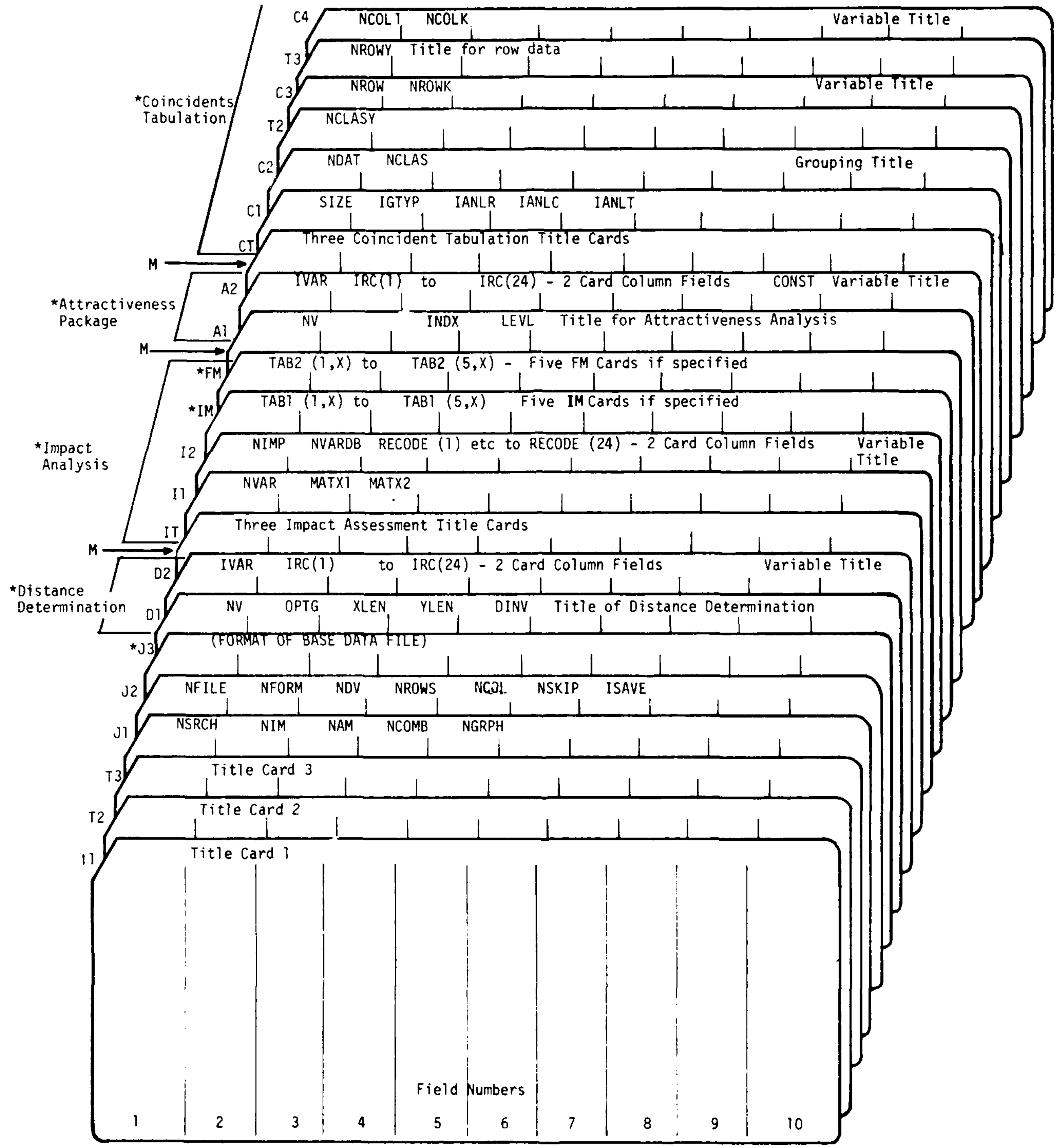
Optional. Required if sublevel text cards included. Signals end of sublevel text card stream.

Card Column	Variable	Value	Description
1-2	NUMS	99	Specifies end of sublevel text card stream.

ME Card

Required. Last card for map package input stream.

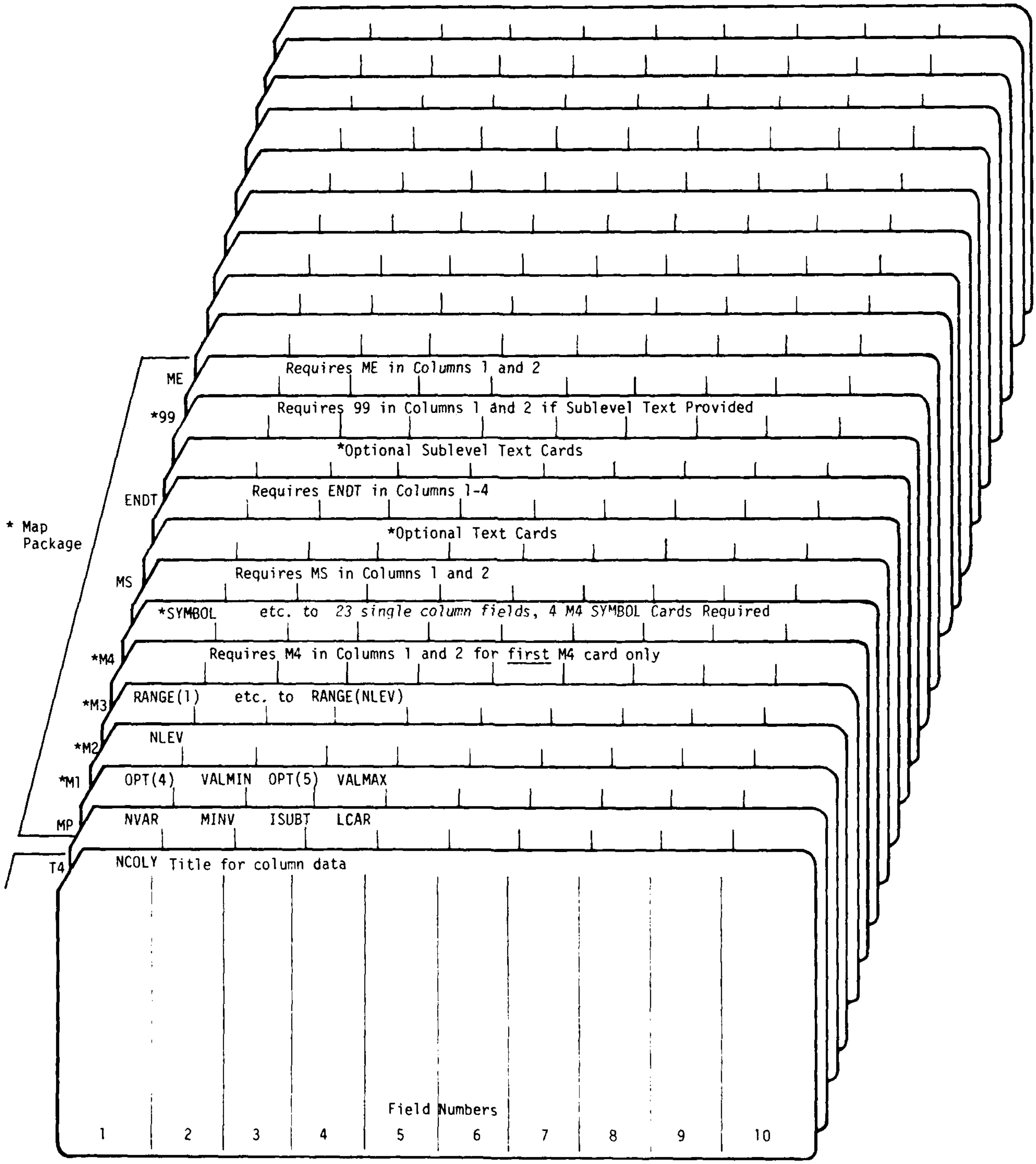
Card Column	Variable	Value	Description
1-2	CHCK	ME	Keys program to return to other operations, mapping is complete.



* Optional

M ——▶ Mapping Cards are inserted here

Figure II-1



* Optional

Figure II-1

EXHIBIT III

This exhibit contains a model work sheet designed to aid in the recoding necessary for performing Locational Attractiveness analysis. Future versions of this manual will include model work sheets for Distance Determination and Impact Analysis recoding requirements.

ATTRACTIVENESS MODEL WORK SHEET

DATE ______________ RUN NO ____________

A1 (1 2) NUMBER OF VARIABLES (8) INDEX (24) ATTRACTIVENESS MODEL FOR (33 34) ____________________

CARD CODE	VARIABLE IDENTIFICATION	RECODING FOR CLASS																								VARIABLE IMPORTANCE	VARIABLE TITLE
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23		
A 2																											
A 2																											
A 2																											
A 2																											
A 2																											
A 2																											
A 2																											
A 2																											

SPK Form 234 Test

Exhibit III
2 of 2

INDEX VALUES

1 - RAW INDEX VALUES

2 - STANDARDIZED BY STANDARD DEVIATION

3 - STANDARDIZED BY DATA RANGE

RECODING VALUES

10 - EXTREMELY DESIRABLE

⋮

1 - LEAST DESIRABLE

0 - NO INFLUENCE

-1 - REJECT FROM CONSIDERATION